

COMPLEX ESCAPEMENT  
RETARD SHUTTER  
PART 1

**CAMERA  
TECHNICIAN  
COURSE**



Em?

**COMPLEX ESCAPEMENT  
RETARD SHUTTER**

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## COMPLEX ESCAPEMENT RETARD SHUTTER

In the various shutters which have been examined in previous lessons, several systems are used to obtain multiple speeds. The box camera shutter exposure can be changed by altering the tension on the main spring or by changing the size of the hole in the shutter disc. In the Dakon-type shutter the speeds are altered by varying the amount of engagement of the main lever with the leaf lever. In simple escapement retard shutters it is possible to vary the speeds by changing the amount of movement of the retard section. When the retard section is engaged for a long period of time a longer shutter speed results. You have also seen that the pallet plays the vital role in an escapement retard system. A simple inertia retard system may also be used. In this case a series of gears may turn against the action of inertia, slowing down the speed of the shutter. An inertia retard system may not give as much delay action as an escapement mechanism (where a pallet is engaged in a star wheel) but speeds as slow as  $1/10$  sec. can be obtained. In the BB, Kodon and some other shutters, it is possible to alter the shutter speeds by changing the amount of tension on the main spring, forcing the main lever to move faster for higher shutter speeds.

Using any one of these systems it is possible to obtain a group of speeds. With main spring tension variation a couple of shutter speeds are possible. With retard movement variation a few shutter speeds can be obtained. By combining two or more systems of shutter speed variation it is possible to have a great many more shutter speeds in one shutter. In the shutters studied thus far, there has been a maximum of perhaps four shutter speeds possible; by combining several of the retarding systems, up to eight or ten different shutter speeds may be possible.

In the more complex multiple-speed shutters the speeds are grouped according to the various delay systems used. Thus, in a typical shutter, there may be several long shutter speeds controlled by an escapement retard system. The gear train may be used at speeds ranging from over one second in duration to as short as  $1/10$  of a



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second. Another series of shutter speeds may exist ranging as slow as  $1/25$  sec. to as fast as  $1/100$  sec., and controlled by an inertia gear train. Still another speed may be controlled by a simple retarding weight, while one high speed may be gained by increasing the spring tension on the main lever.

This method of increasing the number of speeds available in a given shutter will be recognized as the speed range system or the complex escapement retard. You will discover that it is helpful to be familiar with the various speed ranges and how they are obtained when diagnosing troubles in a malfunctioning shutter.

### THE PALLET

It is possible to obtain two speed ranges with similar gear trains:

1. With the use of an escapement retard gear train.
2. With the use of an inertia retard gear train.

These two retard systems are frequently combined in a complex shutter. This is done in a relatively simple manner. With a long geared-up train, ending in a star wheel and pallet, the first gear of the train will revolve slowly, due to the escapement effect of the pallet. This is what you know as the escapement retard.

However, if that same gear train is operated without a pallet, it becomes an effective inertia gear train. Though the first gear in the train will then turn much faster (because there is no pallet at the end of the gear train), there is still a retarding action. Thus, when a pallet is engaged at the end of the escapement gear train, slow speeds ( $1/10$  sec. to 1 second or slower) are available. When the pallet is eliminated, or disengaged completely from the star wheel, less retarding action is afforded and intermediate ( $1/25$  sec. to  $1/250$  sec.) speeds are obtainable.

Thus, many shutters are designed so the pallet is adjustable. It can be disengaged from the star wheel for a completely separate range of speeds. The device provides for two separate speed ranges with essentially one set of parts.

The adjustable pallet also brings to light one more interesting fact. When the pallet is engaged the gear train revolves slowly, while when the pallet is disengaged, it revolves quickly, and the amount of engagement of the pallet with the star wheel is often critical in determining the retard obtainable with an escapement gear train. Indeed, if the pallet is moved close enough to the star wheel, the star wheel will not revolve at all, and the gear train will be jammed. Thus, by adjusting the amount of engagement of the pallet with the star wheel, it is possible to alter the retard given by a particular gear train.

Another factor must also be remembered. That is, as the engagement of the pallet in the star wheel is increased more power is absorbed by the gear train. That's why you will find that if the pallet



is engaged too deeply in the star wheel, the main spring of the shutter will not be strong enough to operate the gear train. Many shutters include an adjustment for the slow shutter speeds through variable engagement of pallet and star wheel.

## THE COMPLEX SPEED CAM

In the simple shutters which have been examined, the speed cam has but a few things to control. It is always necessary, of course, to control **time and/or bulb levers**. So, there is normally a section of the speed cam which is built to do that job. In addition, some section of the speed cam is designed to vary the amount of the retard whether it be an inertia, escapement, or spring-type retard.

In the complex escapement retard shutters the speed cam must control more functions. Not only is the amount of **retard** controlled, but a speed range adjustment is required to engage or disengage the **pallet** depending on which group is desired. Then, there is a series of settings for the **retard lever** with the **pallet** engaged, and a second series of positions for the retard lever with the pallet disengaged.

Another section of the speed cam may control tension on the **main spring**, while still another part may engage or disengage a **retarding weight**, or a **secondary retarding system**.

Examination of speed cams in shutters like the Compur, Prontor, Supermatic, Graflex 1000, and Rapax will reveal several control areas: to operate **time and bulb levers**, **retard levers**, **pallet**, **high-speed spring**, **main spring**, and **retarding weight**.

Of course, no one shutter utilizes every possible means of varying the shutter speed. There are many variations, but you will quickly learn to recognize the functions of the different sections of the shutter in their respective speed ranges.

## THE HIGH-SPEED SPRING

It is always possible to speed up the movement of the main lever by increasing the tension on the main spring. This is not common practice in quality shutters because it is neither efficient, nor dependable.

As an alternate means of increasing the tension on the main lever an additional spring is commonly put into play at the highest speed setting. Such a spring may remain in a completely relaxed position at all settings but the highest speed, when the speed cam engages the spring and puts tension on it. High-speed springs are to be found in many shutters of the complex type. The speed cam is designed so that when it is turned to the highest speed setting, a lug or a milled area on the speed cam contacts the free end of the high-speed spring, putting it under tension.



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The existence of a high-speed spring in a shutter can usually be detected when rotating the speed cam or the setting lever to the highest shutter speed. When a high-speed spring is present, extra force may be required to move the speed cam or the speed setting lever.

Sometimes this test will not prove the existence of a high-speed spring. Since complex multiple-speed shutters are normally of the set-and-release type, final proof comes when there is a difference in force needed to set the shutter at the highest speed.

While the main spring of a between-the-lens shutter may take many different forms, you will find that the high-speed spring is usually a torsion spring.

### THE SUPERMATIC SHUTTER

A good example of a complex escapement retard shutter is the Supermatic, Fig 1, which incorporates features to be found in many other Eastman shutters as well as some foreign shutters.

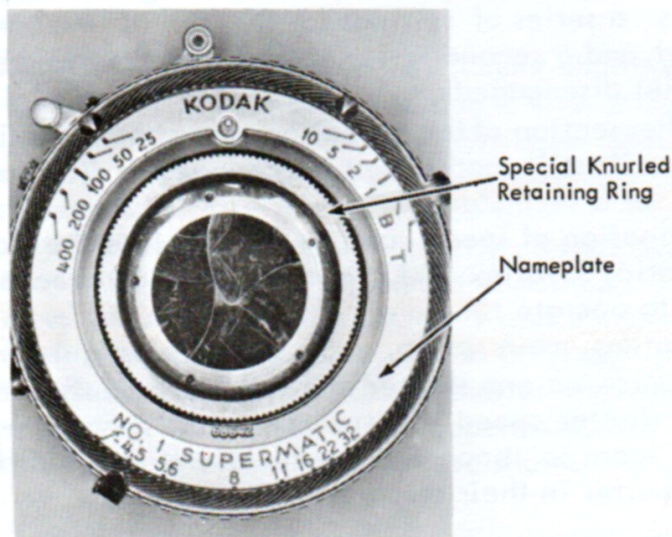


Figure 1

The Supermatic uses a tension-type main spring, combined with a rotary cam-type main lever. The cam-type main lever is reminiscent of the Vario shutter.

Some Supermatic and other Eastman shutters have a bayonet-type nameplate with a screw preventing the plate from turning. When the screw is removed the plate may be rotated slightly, counter-clockwise, and lifted off through clearance grooves. However, the Supermatic model illustrated uses a nameplate which is held in place by the flange of the center lens cell mount. When models of this type are shipped without lenses, a special knurled retaining ring, Fig 1, is used to hold the nameplate in position. When the center lens cell mount or the special knurled retaining ring is removed (unscrewed) the nameplate may be lifted from the shutter.



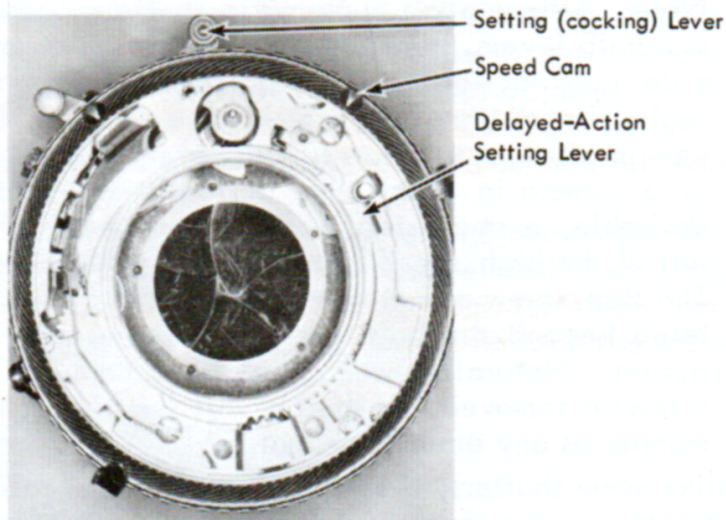


Figure 2

With the nameplate removed it will be seen that the speed cam of a Supermatic shutter does not fit on the lens barrel, but is a ring tracking on the outside of the shutter housing, Fig 2. Encircling the lens barrel you can see a ring lever, the delayed-action setting lever, Fig 2. This lever turns the first gear in the delayed-action gear train which is now hidden under the cover plate. A torsion spring on that first gear supplies power.

Gently hold the speed cam down and rotate it to see the action of the few parts visible through the holes in the mechanism cover. Turn the speed cam as far as it will go in a clockwise direction, Fig 3. Setting and releasing the shutter now will yield "time" action. Notice that the time and bulb lever studs which contact the speed cam are just below the cable release socket resting on the cutaway portion of the speed cam at that point. On "time" both time and bulb levers are free to move.

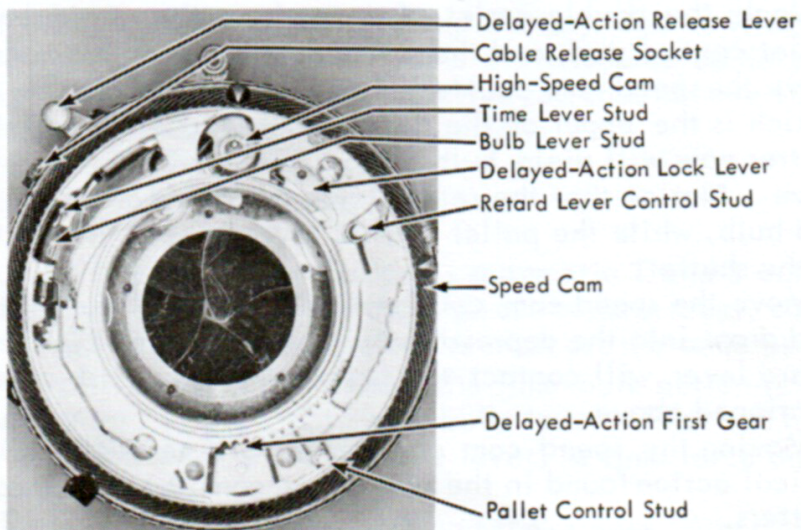


Figure 3



## COMPLEX ESCAPEMENT RETARD SHUTTER

Note: Although all Supermatic shutters contain time and bulb levers, there are some models which only provide bulb action. A contradictory statement? Not really. The determining factor is the distance the speed cam is allowed to rotate. Whenever a shutter is used on a camera in which time action is not necessary or desirable, a small stop screw is installed at the upper left of the high-speed cam cutout in the cover plate. The stop screw prevents the speed cam from being rotated beyond the bulb position. The result - no time action. Naturally, when the speed cam (or the stop screw) is removed, the shutter will function in the same manner as any other Supermatic.

Unlike some shutters, there are no reference calibration marks to indicate how the shutter is set when the nameplate is removed, and you must check the various parts to discover what setting exists. With the cable release socket at 10 o'clock, locate the following parts with reference to figure 3.

1. Delayed-action release lever, just above the cable release socket extending down. This is the top half of a double release lever.
2. High-speed cam (the high-speed spring is located directly under the cam) a part of the main lever assembly.
3. Delayed-action lock lever.
4. Retard lever control stud.
5. Pallet control stud.
6. Delayed-action first gear.

Examine the portions of the speed cam clockwise from each of the control units: the relieved section around the time and bulb levers; another cutaway section from the high-speed spring at 12 o'clock; the double series of steps, from the retard lever to the pallet control stud, and the cutout near the pallet control lever. Move the speed cam counterclockwise until it holds the time lever (which is the upper of the two levers), Fig 4. Operation of the shutter now will yield bulb action, since only the bulb lever can move. Notice that the retard lever is free to move, on both time and bulb, while the pallet control lever is held toward the center of the shutter.

Move the speed cam counterclockwise until the pallet control stud drops into the depression in the speed cam, Fig 5. Now the retard lever will contact the first step of the first series of steps mentioned above.

Moving the speed cam one step at a time will show you the typical action found in the majority of complex escapement retard shutters.



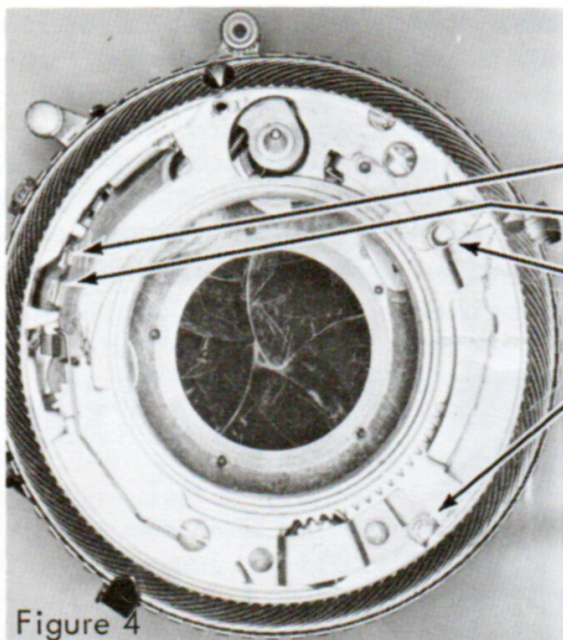


Figure 4

- Time Lever Stud
- Bulb Lever Stud
- Retard Lever Control Stud
- Pallet Control Lever

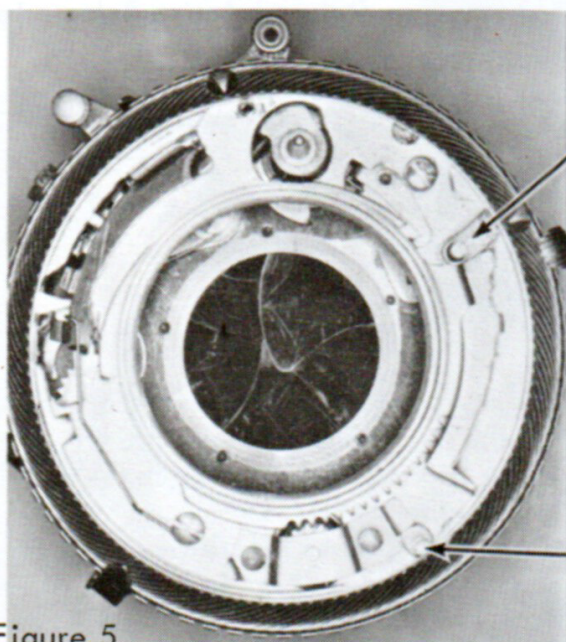


Figure 5

- Retard Lever Control Stud
- Pallet Control Stud

From one second to  $1/10$  sec. the pallet is completely engaged. The travel of the retard lever is varied depending on the setting. From  $1/25$  sec. through the highest speed the pallet is completely disengaged. Again, the retard lever travel is varied until, at the next-to-the-highest speed setting, the retard lever (and the pallet) are completely disengaged. At the highest speed the high-speed spring is brought into engagement with the main lever, adding its energy to that of the main lever spring.

## COMPLEX ESCAPEMENT RETARD SHUTTER

**CAUTION! DO NOT** attempt to operate the delayed action when the nameplate is removed. Simply make the following observations. When the shutter is set, it is possible to rotate the delayed action setting lever, while such movement is impossible when the shutter is in a tripped condition. Look through the hole around the high-speed cam and you will see that the main lever is rotated clockwise when the shutter is set. A lug on the main lever pushes the delayed-action lock lever out of the way while the shutter is being set.

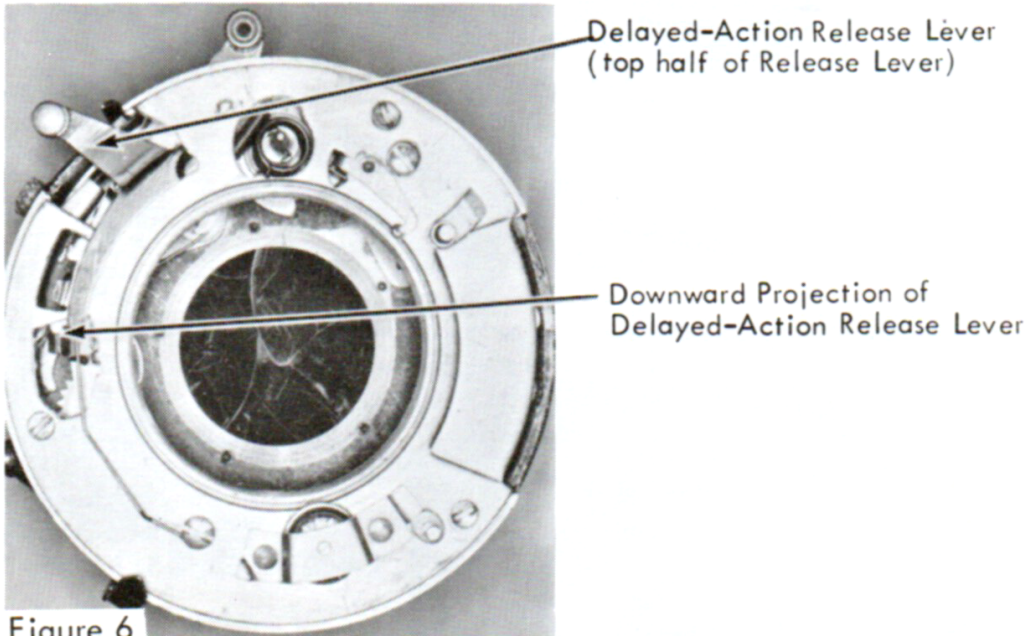


Figure 6

Remove the speed cam by gently lifting it off the shutter. Other parts which may be lifted from the shutter at this time are the delayed-action setting lever and the high-speed cam (which is merely resting on top of the main lever pivot stud).

The delayed-action gear train may start to rotate as soon as the delayed-action setting lever is removed. This is because of the initial tension on the spring in the first gear, and it will be necessary to reset that initial tension during the shutter reassembly. Examine the top half of the release lever (this is the delayed-action release lever), and you will find a projection extending down into the shutter mechanism to contact the delayed-action gear train pallet, Fig 6. That projection may be contacting the pallet and preventing the gear train from winding off the initial tension. Pulling the delayed-action release lever away from the center of the shutter allows the delayed-action gear train to unwind, Fig 7. Watch the star wheel rotate and the pallet vibrate while it unwinds.



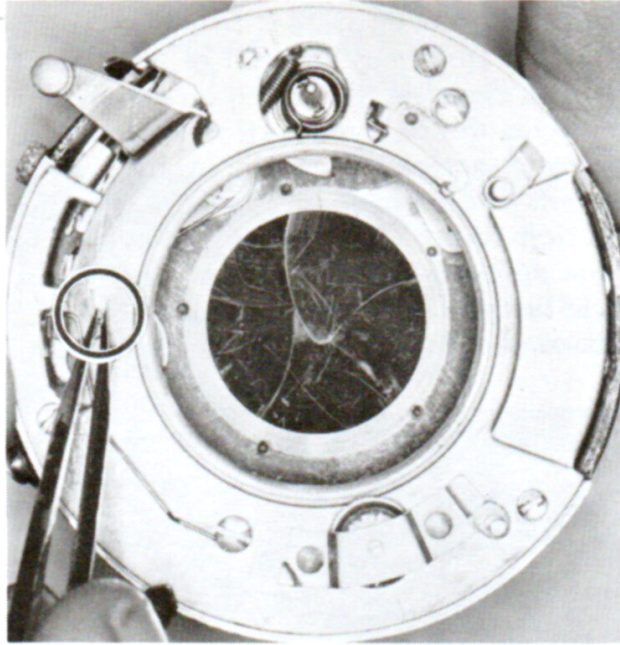
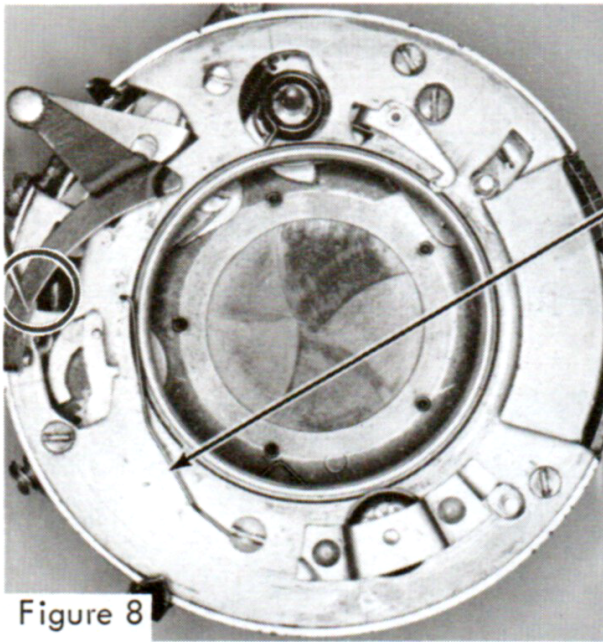


Figure 7



Delayed-Action Release  
Lever Spring

Figure 8

Disengage the delayed-action release lever spring by lifting it up and allowing it to come to rest against the lens barrel, Fig 8. It is then possible to move the delayed-action release out of the way, lifting gently and springing it enough to rotate it counter-clockwise, clear of the shutter, Fig 8. **BEWARE** of the possibility of bending this portion of the release lever--spring it just enough to clear. Three screws are now visible as shown in figure 8, which hold the mechanism cover plate in position. Remove those three screws (notice that the short screw was positioned at 1 o'clock)

# COMPLEX ESCAPEMENT RETARD SHUTTER

and gently lift the mechanism cover plate from the shutter.

When the mechanism cover plate is lifted off, the first gear of the delayed-action gear train may fall out of position, Fig 9. In any case, lift it up and examine the spring on its underside. It is this spring which drives the delayed-action mechanism. The second gear of the delayed-action gear train includes a unique one-way clutch. It permits the delayed-action spring to be wound while the delayed-action control lever is rotated even though the pallet is locked by the delayed-action release lever. Hold the delayed-action pallet with one finger and it is possible to rotate the top part of the second gear in a clockwise but not a counterclockwise direction.

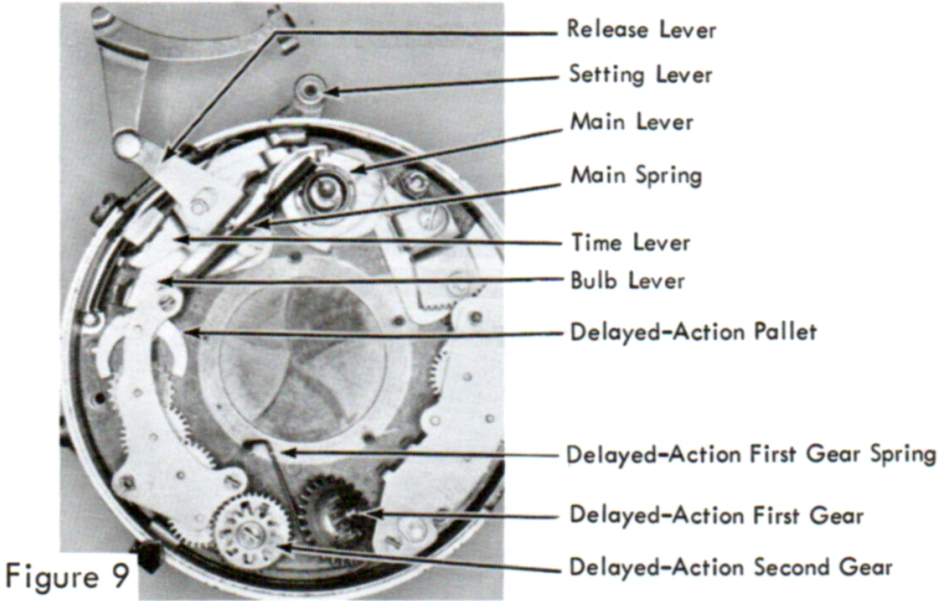


Figure 9

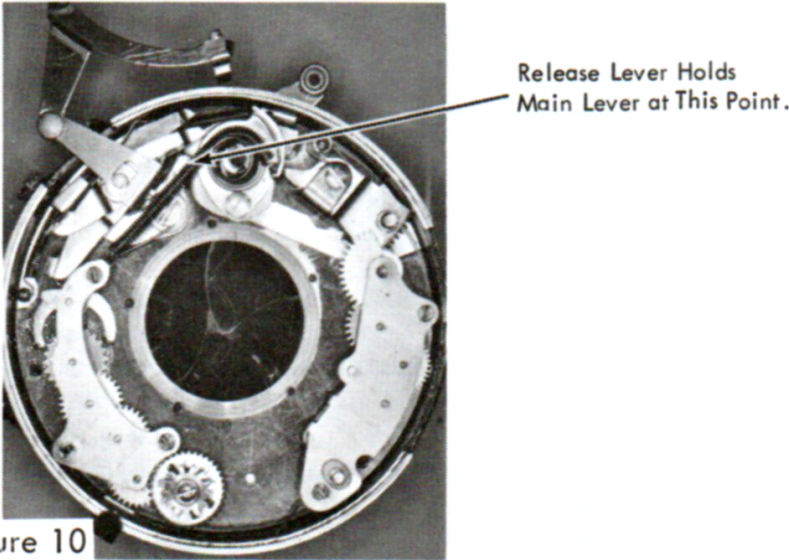
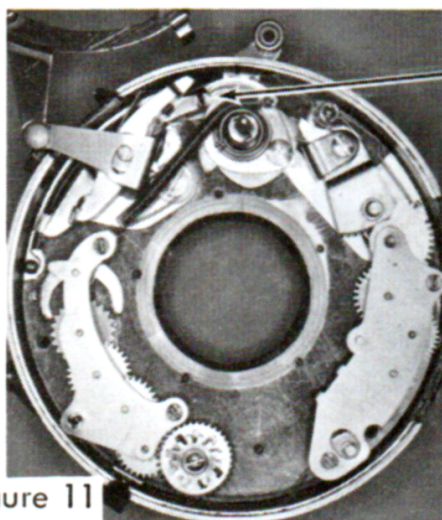


Figure 10

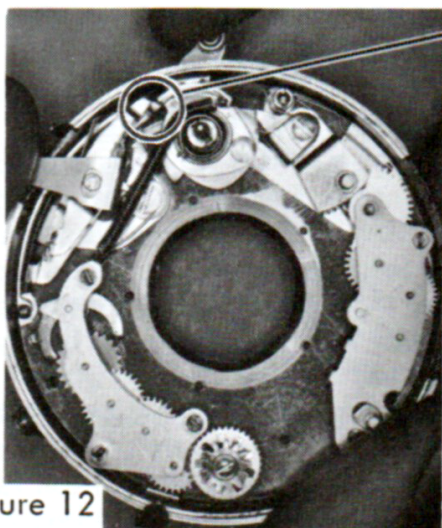


Several important features may be noticed with the shutter at the present stage of disassembly. The main spring is of the tension type extending from the delayed-action gear train cover plate up to the cam-type main lever. Operating the release lever while the shutter is in the tripped position will demonstrate the movement of the time and bulb levers. Set the shutter slowly and observe the portion of the release lever which holds the main lever in the set position, Fig 10. Tripping the shutter will make it operate on "time", but since there is nothing to restrict the movement of the time and bulb levers, be careful to avoid jamming the bulb lever inside the main lever as illustrated in figure 11. If the main lever reaches this position you cannot move the release lever to complete the time cycle, and it will be necessary to reset the shutter, and then release the shutter again, carefully limiting the amount of stroke of the release lever, Fig 12. In so doing, you can prevent excess movement of the bulb lever and avoid the lockup of the main lever.



Bulb Lever Jammed Against Main Lever at This Point

Figure 11



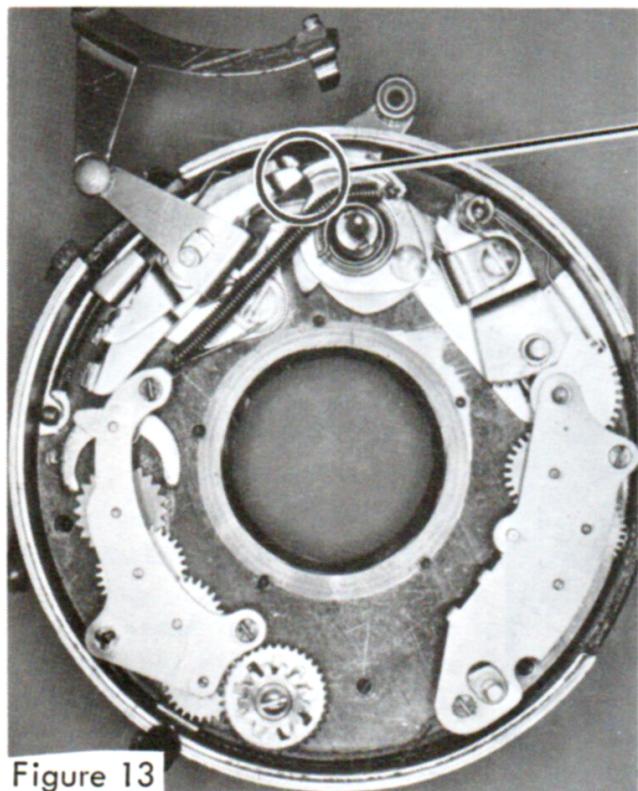
Correct Engagement of Bulb Lever Against Main Lever

Figure 12



## COMPLEX ESCAPEMENT RETARD SHUTTER

Then, when you lift your finger from the release lever the time lever will move into position holding the blades in the open position, Fig 13. Depressing the release lever again, the time lever will disengage and the shutter will return to the closed position.



Engagement of Time  
Lever Against Main  
Lever

Figure 13

## INTRICATE TIMING IN THE SUPERMATIC SHUTTER

Make a detailed examination of the arrangement of parts in this retard gear train in order to understand reassembly.

Certain facts which you already know will aid in the reassembly of any train of gears in an escapement system. The first gear in the train, whether it be a delayed action or a retard section, is usually distinctive (as the retard lever). In the case of the Supermatic shutter the spring-wound first gear in the delayed action stands out. The other end of the gear train, of course, includes a star wheel and a pallet. Comparison of the star wheel with the gears in the same train will quickly reveal that the shape of the gear teeth is completely unlike the pointed teeth of the star wheel. It is easy to remember whether the star wheel or its pinion go up or down by observing the position of the pallet. In the Supermatic shutter, for example, the delayed-action star wheel pinion is up while the retard section star wheel pinion is down, Fig 14 and 15.



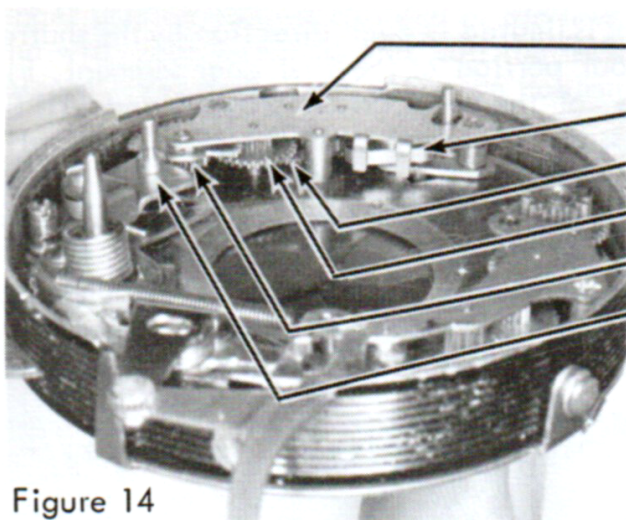


Figure 14

Retard Cover Plate  
Pallet  
Third Gear (behind post)  
Second Gear  
First Gear Segment  
Retard Lever

Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

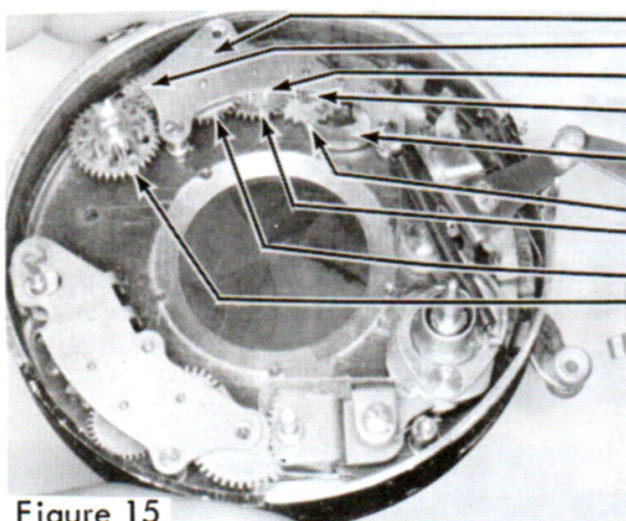


Figure 15

Delayed-Action Cover Plate  
Third Gear  
Fifth Gear Pinion  
Star Wheel Pinion

Pallet  
Star Wheel  
Fifth Gear  
Fourth Gear  
Second Gear

Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

The delayed-action is perhaps the more complex of the two gear trains in the Supermatic shutter, but observe that the fourth gear (the first gear was removed previously) is the only one with its pinion down, and it has a section turned away to clear the gear of the fifth assembly in the train. This factor alone will aid considerably in the reassembly of the gear train. Both third and fifth gears are assembled with the pinion up, but the fifth gear is mounted a little higher on its shaft.

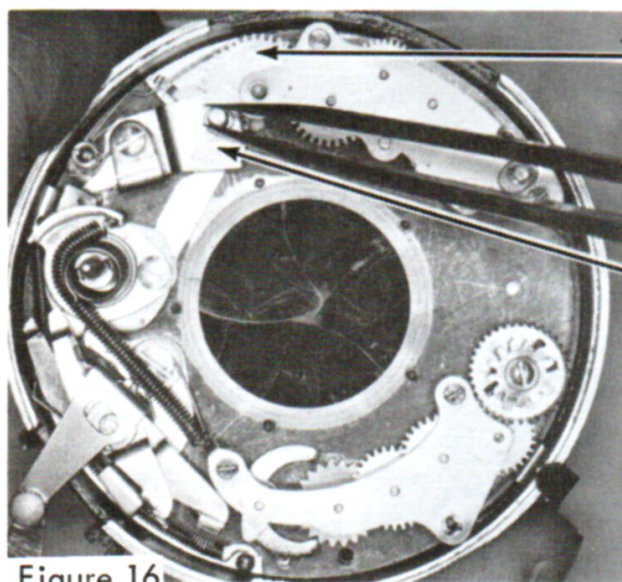
The position of the several gears in the retard section are not easily observed at this stage, but since there are fewer of them little difficulty will be encountered. Notice that the gear segment (the gear meshing with the retard lever) is fastened permanently to the retard cover plate. The two gears between the gear segment and the star wheel are both mounted pinion up, but the second gear is higher on its shaft than the third, Fig 14.



## COMPLEX ESCAPEMENT RETARD SHUTTER

With the shutter in the set position, move the retard lever and observe how its movement is limited in each direction by the shutter housing and/or the cutout portion of the first gear segment, Fig 16 and 17. The "timing" of the two parts is critical and will be covered later in your lesson. Different models of the Supermatic will vary slightly in this timing.

Remove the two screws holding the retard section cover plate in position. By holding the retard lever while lifting the retard cover plate gently, you can observe the positions of the gears with a minimum of disturbance. The gears in the train, the star wheel, and pallet are now easily identified, Fig 18.



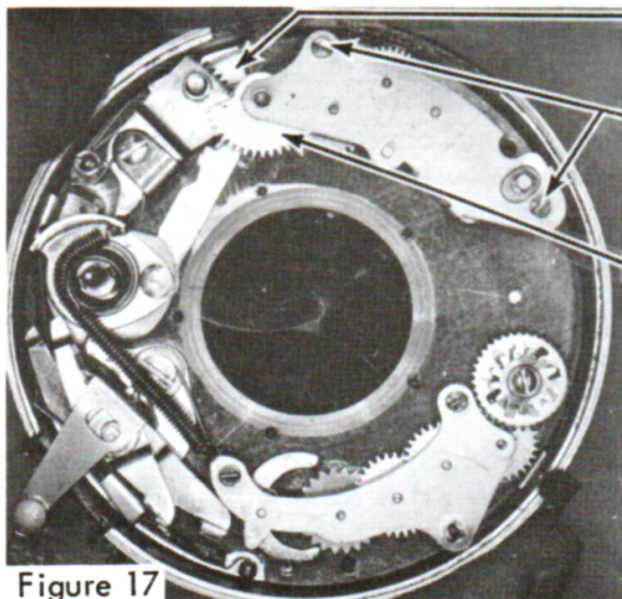
First Gear Segment

Retard Lever

Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

Figure 16



Retard Lever

Retard Cover Plate Screws

First Gear Segment

NOTE:

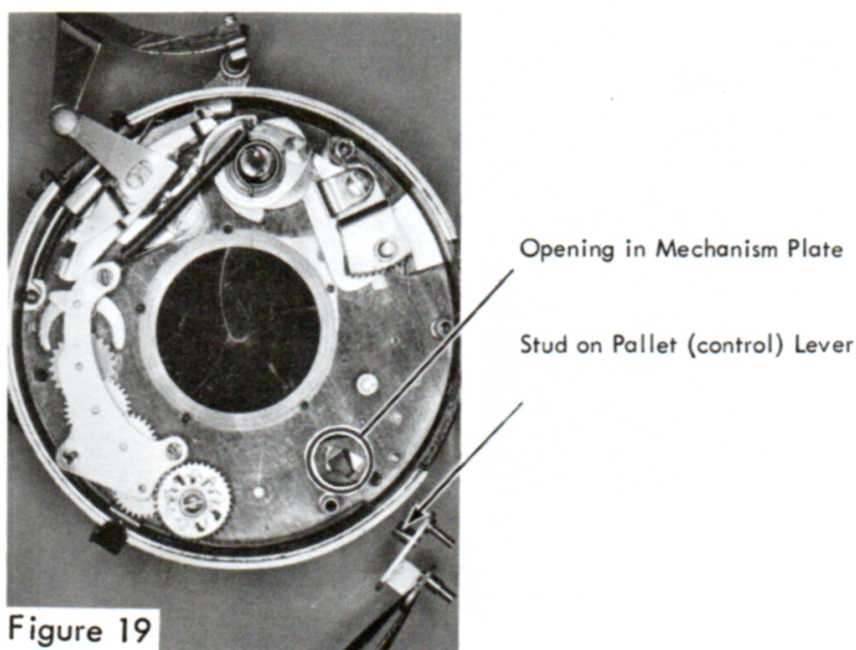
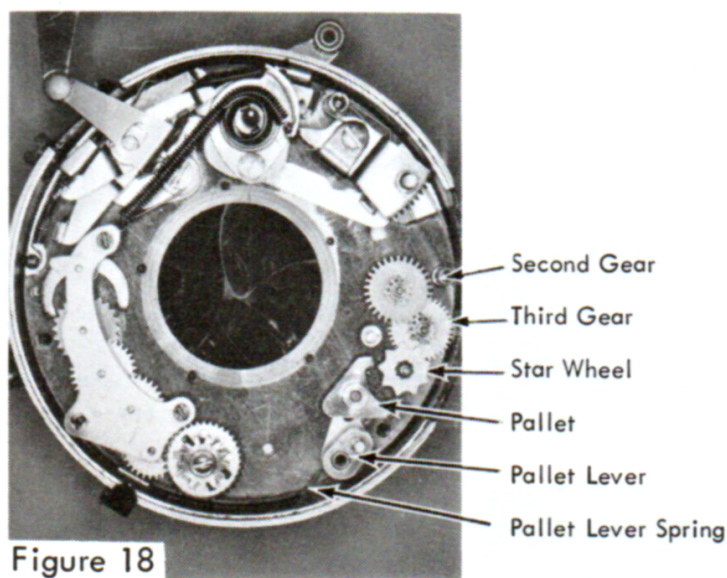
"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

Figure 17



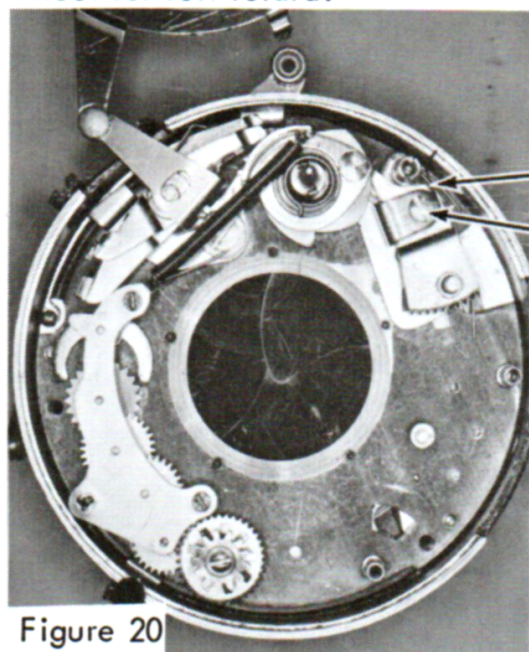
Lift the second gear, star wheel, and the third gear out of the shutter, in that order. The pallet spring is held much like the main spring in the Dakon shutter. Disengage the pallet spring from its position and it will be possible to lift both the pallet lever and pallet from the shutter assembly.

Notice the opening in the shutter mechanism underneath the pallet control lever. A stud on the pallet lever passes down through that opening, Fig 19. Part of the shutter setting lever under the



## COMPLEX ESCAPEMENT RETARD SHUTTER

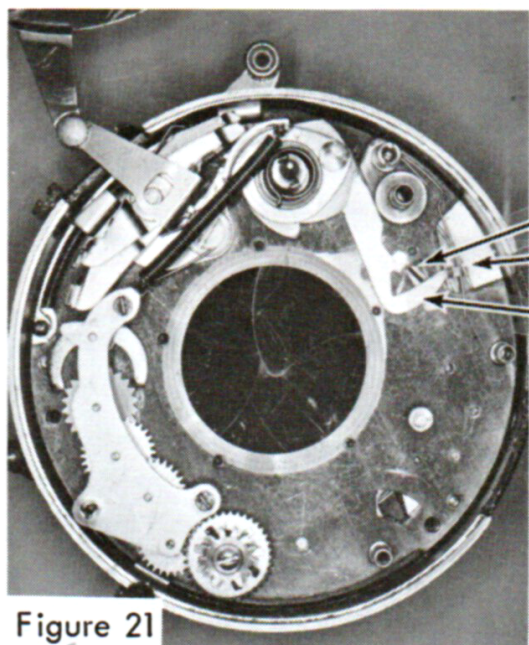
mechanism plate extends to this opening when the shutter is set, pushing the pallet lever and pallet out of engagement with the star wheel. As the shutter is tripped the setting lever moves away from the opening, allowing the pallet to engage with the star wheel for full retard.



Disengaged Retard Lever Spring

Retard Lever Screw

Figure 20



Shutter in Rest Position

Blade Operating Ring Stud

Leaf Lever Spring

Leaf Lever

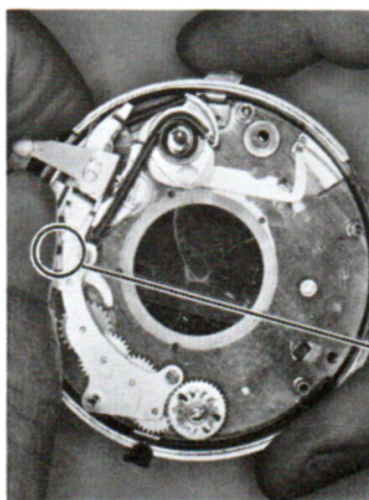
Figure 21

The retard lever spring is also positioned around the retard lever pivot post, with both ends pointing to the left. Disengage the upper end of the retard lever spring from its position against the slotted



post, Fig 20. Remove the screw holding the retard lever, and lift the retard lever, with its spring, off the pivot post.

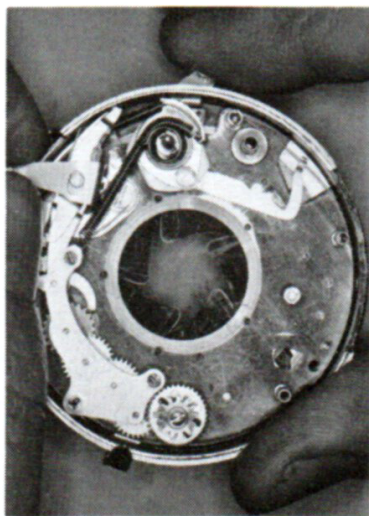
The leaf lever, the leaf lever spring, and their relationships to the blade operating ring can now be seen, Fig 21. Using a technique which allows the shutter to move slowly will show the action of these parts. Hold the time and bulb levers toward the center of the shutter with the thumb of your left hand while keeping the first finger of the same hand free to operate the release lever. At the same time cock the setting lever with the first finger of your right hand, Fig 22. Now, holding back the setting lever so the shutter can move through its operating cycle release the shutter slowly, Fig 23. Notice that the shape of the leaf lever prevents it from opening and closing the blades while the shutter is being set. The leaf lever spring is intended solely to maintain contact between the leaf lever and the blade operating ring. It does not close the blades as is the case in most of the shutters you have studied.



Shutter in Set (cocked) Position

Time and Bulb Lever Studs  
Held Toward Center of Shutter

Figure 22



Shutter in Partially  
Released Position (leaf  
lever has picked up blade  
operating ring stud, opening  
the shutter blades)

Figure 23

## COMPLEX ESCAPEMENT RETARD SHUTTER

Disengage the lower end of the main spring from the delayed-action cover, and then lift off the high-speed spring, Fig 24.

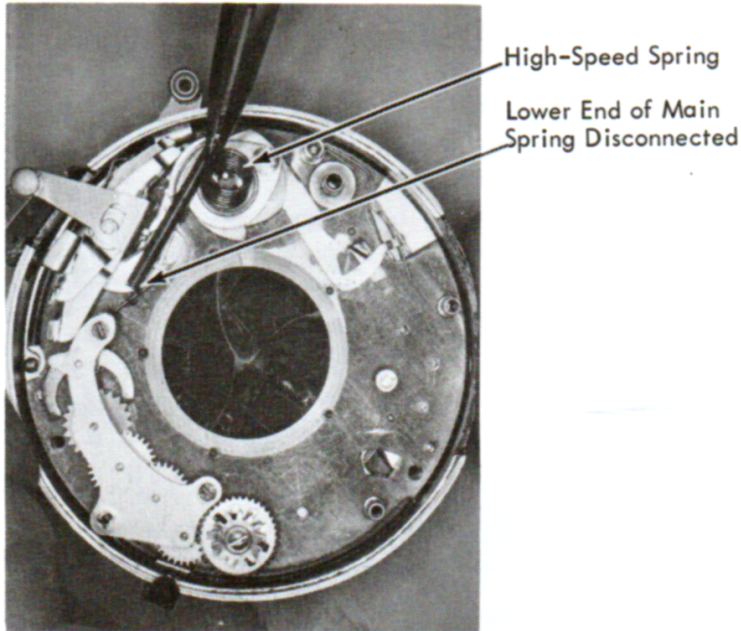


Figure 24

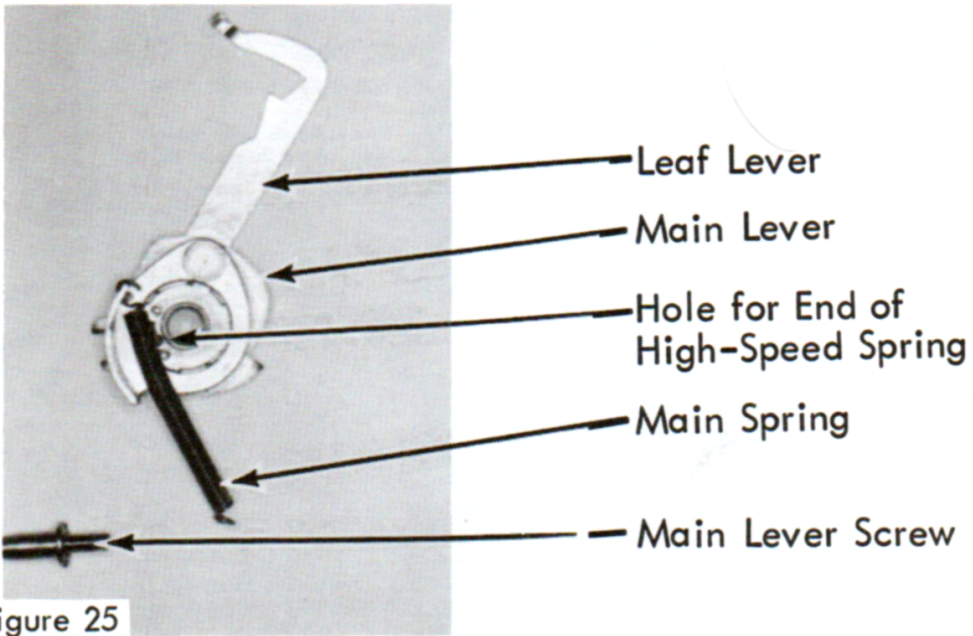


Figure 25

Disengage the leaf lever spring from the leaf lever. Remove the notched screw holding the main lever, using your MultiSpan Wrench with appropriate tips, and lift the main lever off its pivot. (Some models use a retaining screw which is hex-headed instead of notched - in this case a #2 socket wrench may be used). Note the hole in the main lever into which the end of the high-speed



spring was fitted, Fig 25. Disengage the release lever spring from the support stud of the delayed-action gear train, and remove the release lever screw. Notice the positions of the spring and washer under the screw, Fig 26. The release lever acts as a retainer for the time and bulb levers (which are mounted on a separate stud under the release lever). The springs on both time and bulb levers are fastened permanently to the levers so they can't be lost. It is possible to work the release lever out from under the time and bulb levers without disturbing those two levers excessively, Fig 27.

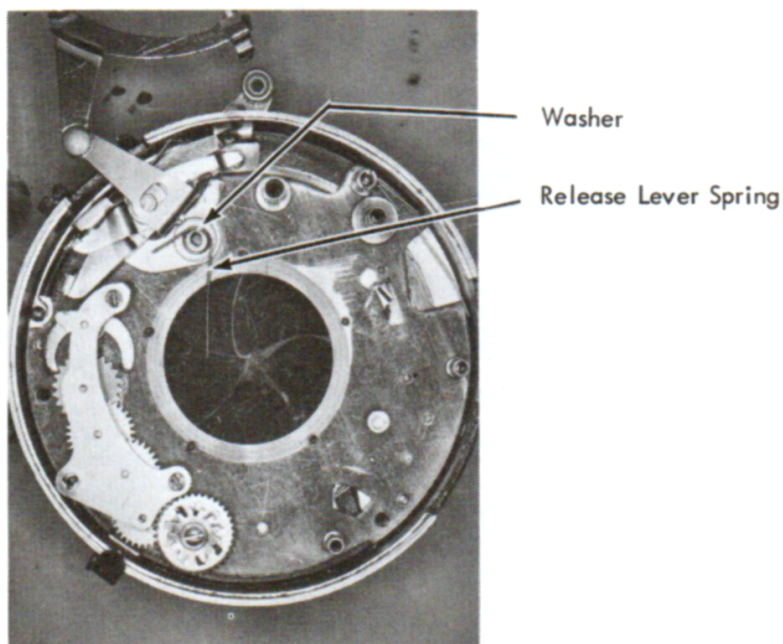


Figure 26

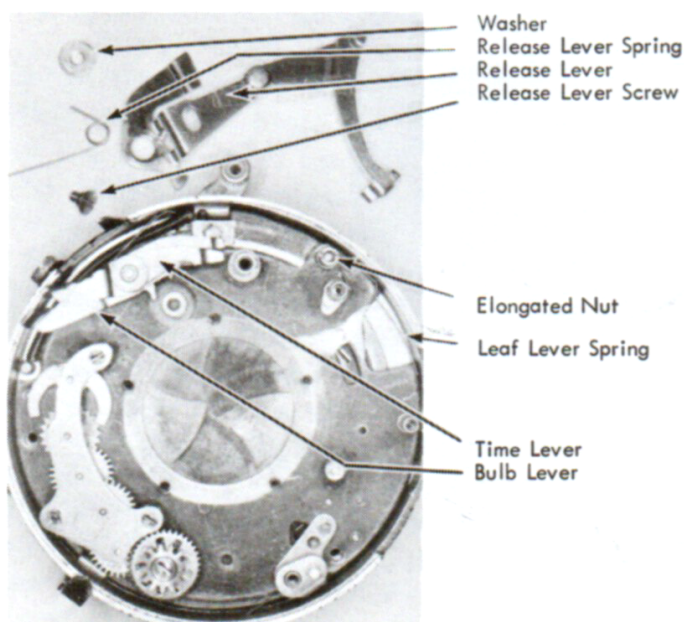


Figure 27

## COMPLEX ESCAPEMENT RETARD SHUTTER

Both time and bulb levers may now be lifted up and off their stud. The leaf lever spring is held in place with an elongated nut, Fig. 27, which may be removed with a screwdriver.

After removing the leaf lever spring, turn the shutter over to reveal the four screws through the back of the shutter which retain the mechanism plate in the housing, Fig. 28. These screws may be removed with the shutter upside down, but hold the mechanism plate in position in the housing with your hand while the screws are being turned out. (On some models, such as the one illustrated, part of the shutter release linkage may be held in place by two of these screws. In addition to the four screws mentioned, a fifth screw located under the release linkage is sometimes used.

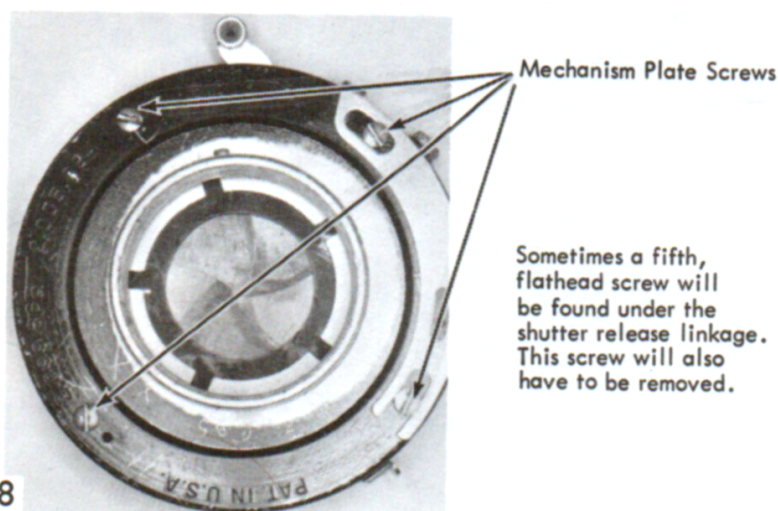


Figure 28

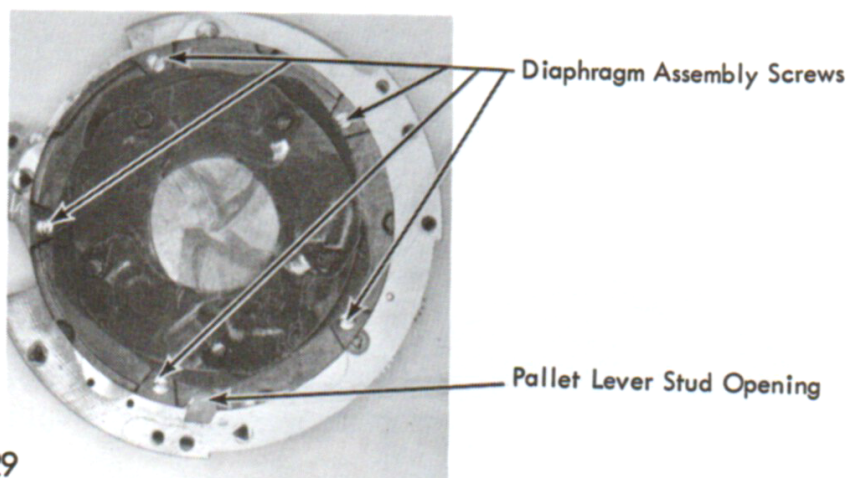


Figure 29

Find the opening through which the pallet lever stud is moved, Fig 29. This opening will serve as an alignment clue during reassembly of the diaphragm plate. Remove the five screws and carefully lift off the diaphragm assembly.



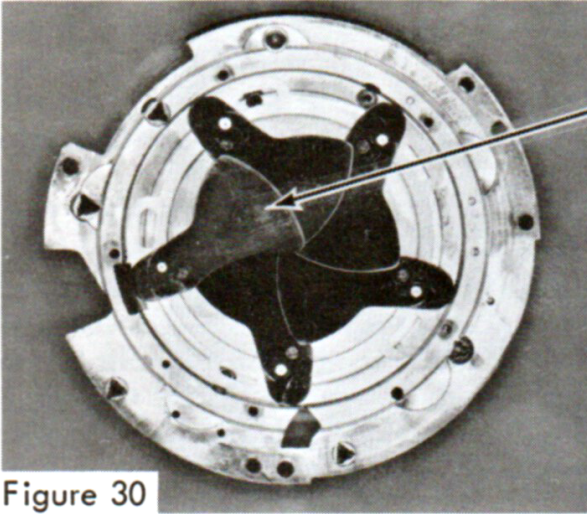


Figure 30

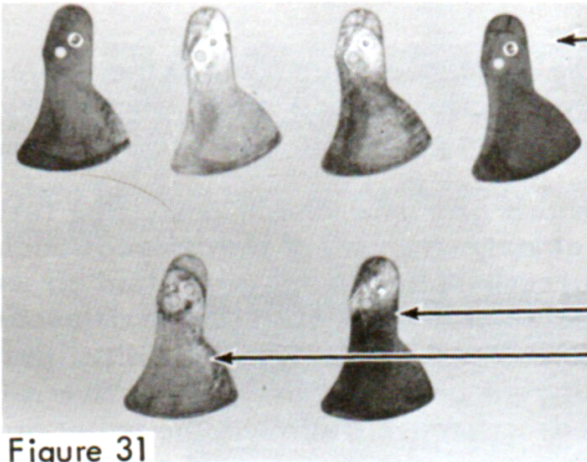


Figure 31

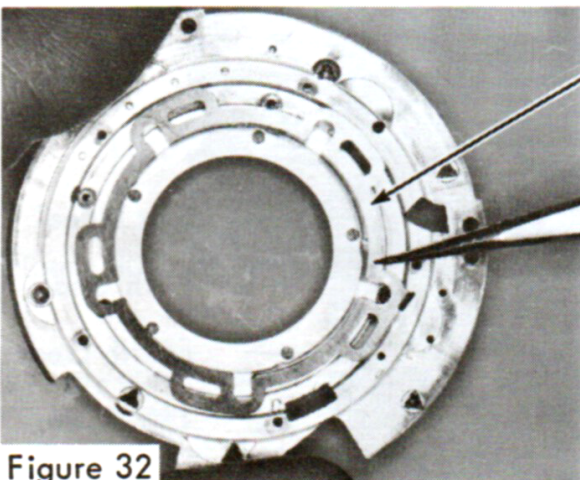


Figure 32

First and Sixth  
Blade Position

Second, Third, Fourth and  
Fifth Blades

First Blade

Sixth Blade

Blade Operating Ring

Note:  
"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

## COMPLEX ESCAPEMENT RETARD SHUTTER

With the shutter still upside down, gently lift the housing from the mechanism plate. Allow the diaphragm operating ring and setting lever to hang free in the shutter housing if they are loose and set the housing aside on your bench. Carefully move the individual diaphragm wings toward the center of the shutter and the five screws holding the diaphragm assembly to the mechanism plate will be revealed, Fig 29.

In this shutter there are six blades in five positions, with the first and sixth blades located at one pivot position, Fig 30. Four of the blades are identical while the first and sixth blades are designed for their unique positions. The sixth blade has no pins assembled to it while the first blade has an added pin which fits a hole in the sixth blade, Fig 31. With the blades removed, lift off the blade operating ring, Fig 32, and turn the mechanism plate assembly over again for the disassembly of the delayed-action gear train.

Some Supermatic shutter mechanism plates have the blade operating ring permanently assembled to the plate by means of a retaining cover riveted in place.

One of the screws which held the mechanism plate in the shutter housing passed into a delayed-action support stud. That's why disassembly of the delayed-action gear train had been delayed until now.

The screw holding the second gear, the clutch gear, (the first gear and drive spring were already removed) of the delayed action can now be removed and that combination clutch gear lifted off its pivot post. The two screws holding the cover plate of the delayed-action gear train may be removed and the cover plate carefully lifted straight up to avoid disturbing the gears underneath. The five remaining gears of the delayed-action gear train and the pallet are clearly visible--recheck their positions, Fig 33.

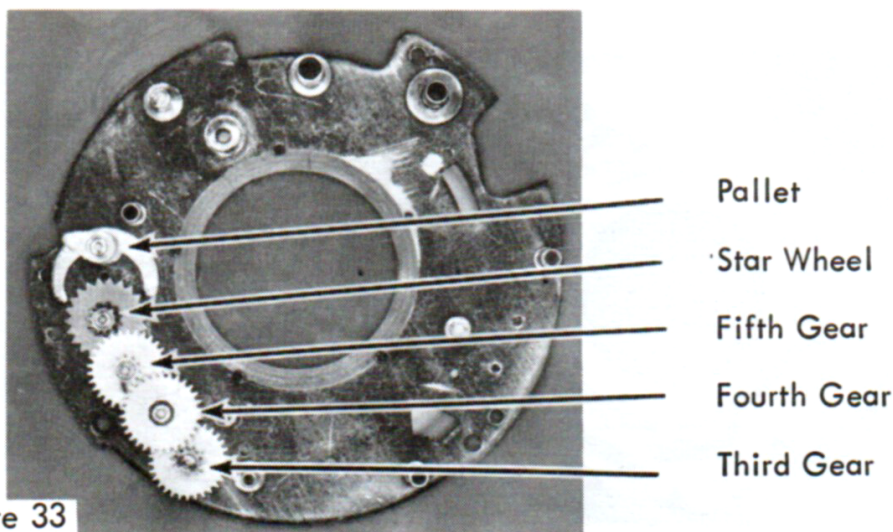


Figure 33



The star wheel and the third gear are the only parts that fit close against the mechanism plate, while the only gear which appears to be "upside down" is the one with a groove turned in its pinion, (fourth gear).

The gears may now be lifted out starting with the fourth gear and ending with the star wheel and pallet.

## REASSEMBLY OF THE SUPERMATIC SHUTTER

Examine the diaphragm operating ring and setting lever which are still assembled to the shutter housing. Fit the diaphragm operating ring into the counterbore in the center of the shutter housing. Make certain you do not force any of the several bends in the diaphragm operating ring pointer, Fig 34.

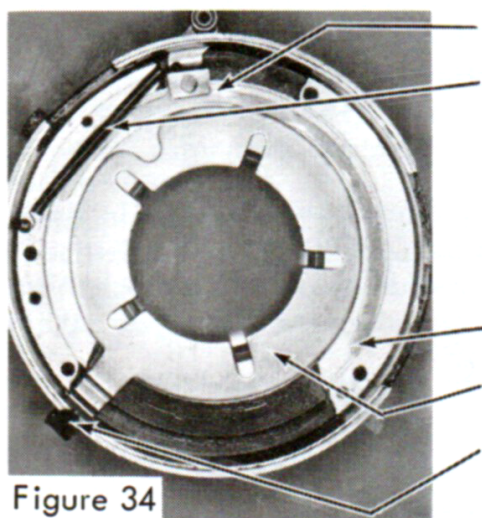


Figure 34

- Shutter Setting Lever
- Shutter Setting Lever Spring
- Pallet Lever Contact Point
- Diaphragm Operating Ring
- Diaphragm Operating Ring Pointer

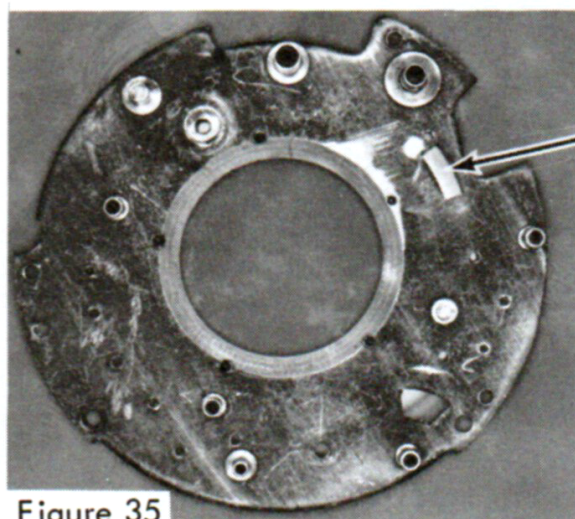


Figure 35

- Leaf Lever Opening  
(hole for blade operating  
ring stud)

## COMPLEX ESCAPEMENT RETARD SHUTTER

The shutter setting lever is a separate assembly with its own return spring. Find the cutout at its extreme right-hand end which contacts the stud on the pallet lever.

On some models, there may be an extension on the outer surface of the setting lever, which is contacted by a press-focus button. When the press-focus button is pushed in, it intercepts the movement of the setting lever. Since the setting lever is keyed to the main lever this stops the action of the shutter when the blades are wide open. When the shutter is reset an internal spring returns the press-focus button to its normal position and the next tripping action of the shutter will be complete. The press-focus feature will be discussed in more detail later in your lesson.

The mechanism plate assembly may be oriented as in figure 35, with the main lever pivot post at 2 o'clock. The first section to be assembled to the plate is the delayed-action mechanism. Install the pallet, the star wheel and then the third gear at the other end of the gear train, Fig. 36.

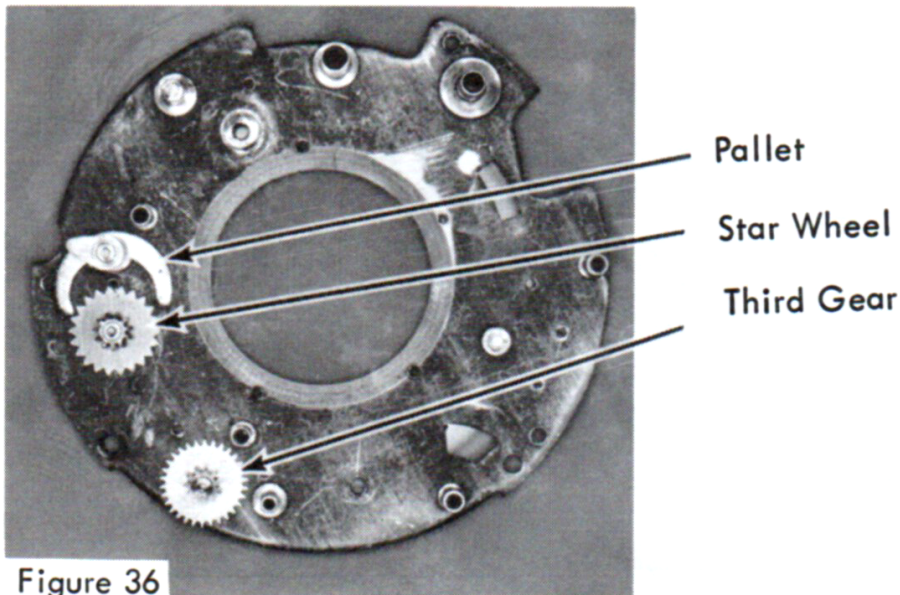


Figure 36



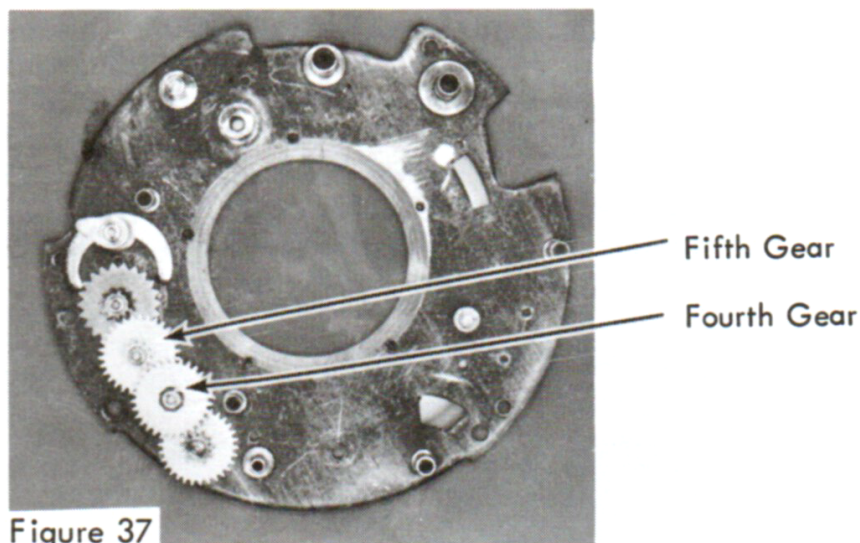


Figure 37

Next, replace the fifth gear and then the fourth gear with its pinion turned down, Fig 37. With the four gears placed in position in their bearing holes replace the delayed-action cover plate and the two screws which fasten it from above. Gently adjust its position until all of the pinion pivots fit into their respective bearing holes. One trick which can help you complete this and similar tasks (which may sometimes be ticklish) is to align one of the screw holes and fasten the cover plate very lightly by turning the screw a couple of turns before attempting to completely align all of the pivots. When all the pivots are in position tighten the screw. Check the operation of the gear train by turning the third gear in the train (at the end opposite from the star wheel).

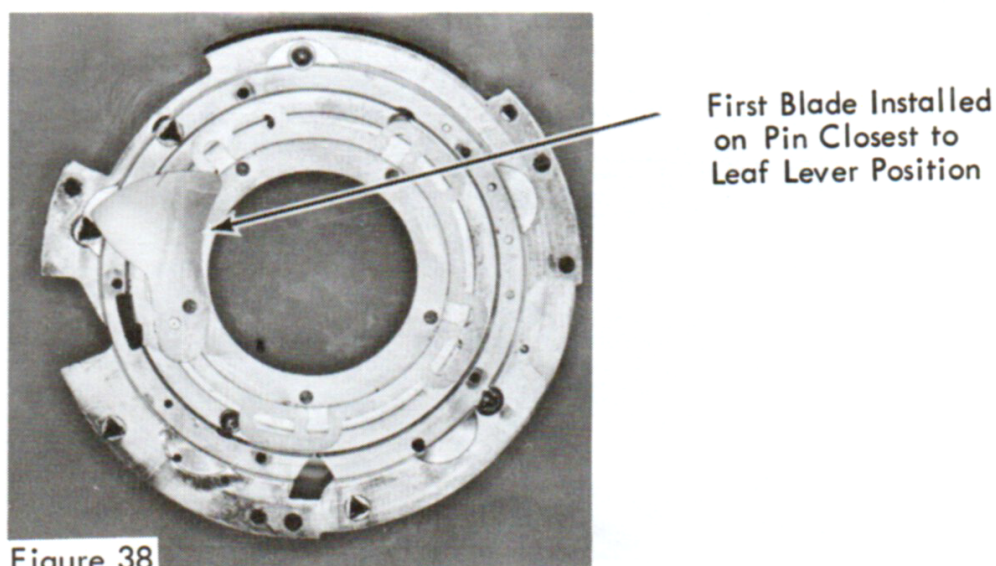


Figure 38

## COMPLEX ESCAPEMENT RETARD SHUTTER

Turn the mechanism plate over and install the blade operating ring. Move it to the open position ( counterclockwise as seen from the bottom). It is usually easier to assemble blades while they are in the open position, although some shutters are more easily assembled closed. The Supermatic shutter blades are assembled in the open position. Replace the shutter blades with caution: the first shutter blade is the one with the double stud, Fig 38, after which the others are placed one at a time in a counterclockwise direction, so that the last blade (with holes only) goes on top of the first (with the double stud) blade.

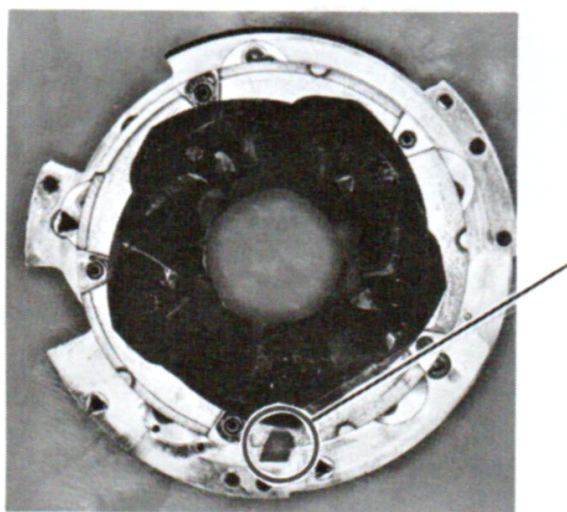


Figure 39

With all of the blades installed replace the diaphragm wing assembly. Align the pallet control opening in the mechanism plate assembly with the notch in the diaphragm assembly, Fig 39. Before the screws are tightened recheck the shutter blades and blade operating ring for freedom of movement.

If the blades are operating freely, open the blades and move the diaphragm wings to the wide-open position. Rotate the diaphragm control ring as far clockwise as it will go, setting it at the wide-open position, Fig 40.

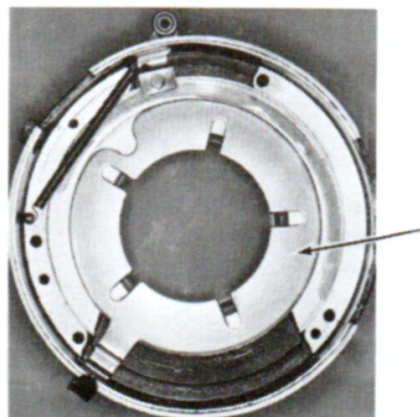


Figure 40

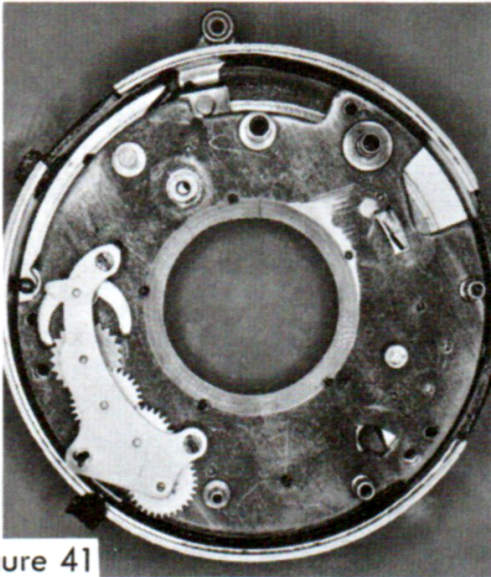


When replacing the mechanism plate in the shutter housing be sure that:

1. The diaphragm wings fit into the slots in the diaphragm control ring.
2. The setting lever rides in its groove close to the outer edge of the shutter housing.
3. The setting lever spring fits in the space between the shutter mechanism plate and the shutter housing in an arc around the shutter mechanism plate.

The latter is accomplished in the following manner:

1. Disregard the position of the setting lever spring, but verify that the setting lever does fit in its groove close to the outer edge of the shutter housing.



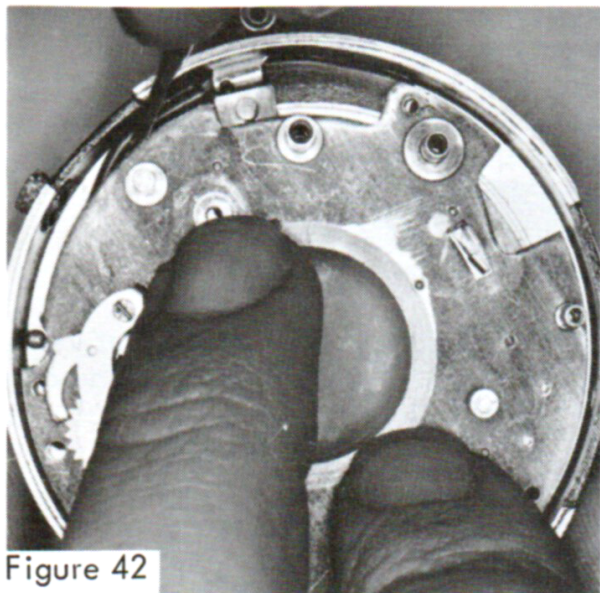
Correct Alignment  
Position for Initial  
Installation of Mechanism  
Plate

Figure 41

2. Align the shutter housing and mechanism plate as illustrated in figure 41 and locate the screw holes in both the shutter housing and shutter mechanism plate which will be used to fasten the mechanism plate into position.
3. Gently lower the mechanism plate into position on the inside of the housing with these alignment facts in mind. Figure 41 shows the exact position in which the parts should go together.

## COMPLEX ESCAPEMENT RETARD SHUTTER

4. Hold the mechanism plate down firmly with your left hand and move the setting lever slightly until the mechanism plate seats itself a little more completely. It is not in its final position, however, for you will find that the shutter setting lever spring is now underneath the mechanism plate.



Setting Lever Spring  
Being Probed into  
Correct Position

5. Avoid putting excess pressure on the mechanism plate. Use the point of a screwdriver, Fig 42, to work the spring out from under the mechanism plate. Starting at the setting lever, work towards the other end, allowing the mechanism plate to settle further and further into the shutter housing as the spring is urged into its proper place. You must be Very Gentle in handling this spring to avoid stretching it. As soon as the spring is worked out from under the mechanism plate, the plate will slip down firmly into its position in the shutter housing.

Holding the mechanism plate in position, turn the shutter housing over and replace the screws holding the mechanism plate in the shutter housing, but Do Not tighten them completely.

Test the diaphragm by moving the diaphragm control lever gently. If the diaphragm control lever does not move, loosen the screws holding the mechanism plate. It may be necessary to gently move some of the diaphragm wings before the screws are tightened to properly engage them in the slots of the diaphragm control ring. When the diaphragm wings are seated and operating properly, and the setting lever spring encircles the mechanism plate, tighten down the mechanism plate retaining screws and make a final check for free movement of the parts already inserted.



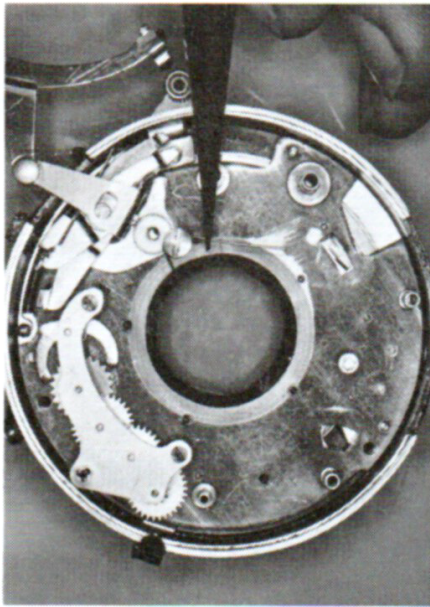
The diaphragm should be wide open when the diaphragm control lever is as far to the left as it will go.

Install the time and bulb levers on their post. Make certain that the bulb lever (with its spring mounted on the bottom) is placed in position first, followed by the time lever (which has its spring fastened on the top). It is not necessary to push these levers as far as they will go on their post until the release lever assembly is installed.

Fit the release lever so that it straddles the time and bulb levers and fits over its own pivot. Replace the washer, spring, and screw with both ends of the spring pointing down. The short end of the spring contacts the release lever.

Here's one method of handling a shouldered screw and spring assembly of this type:

1. Hold the screw in the loop of the spring as in figure 43.



Release Lever Spring  
and Screw Being  
Lowered into Proper  
Position

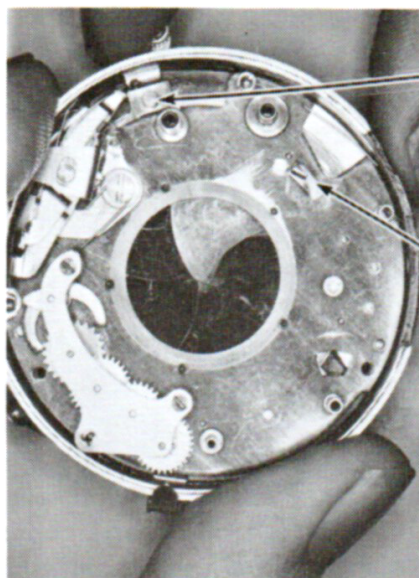
Figure 43

2. Then, use the spring as a means of support and lower the screw to the tapped hole.
3. Turn the screw into position. This method will help prevent the spring from moving out of place at the wrong time.

Make certain that the screw is firmly seated yet permits free movement of the release lever. Hook the long end of the spring behind the delayed-action gear train cover support.

Install the leaf lever spring and then screw on the long, round retaining nut.

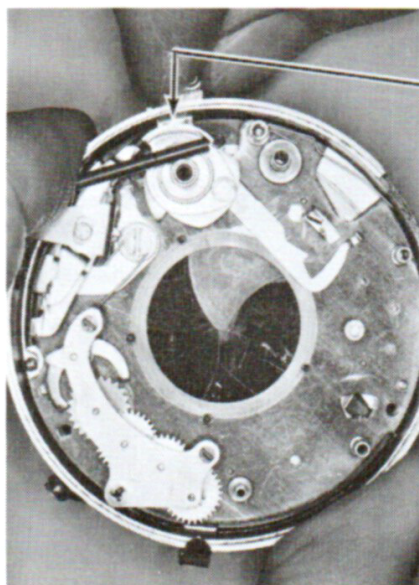
## COMPLEX ESCAPEMENT RETARD SHUTTER



Stud on Setting Lever  
which Fits into Fork  
of the Main Lever  
(main lever not installed)

Shutter Blades Closed  
by Moving Blade Operating  
Ring Stud All the Way  
Counter Clockwise

Figure 44



Main Lever Lowered  
into Position with Fork  
Straddling Pin on Setting  
Lever

Figure 45

Replace the main lever on its shaft. The stud on the setting lever must fit into the fork on the main lever so that movement of the setting lever also moves the main lever, Fig 44 and 45. Fasten the main lever in with its special hex-headed or notched screw.

Engage the main spring with the tab on the delayed-action cover plate. Engage the leaf lever spring with the hook on the end of the leaf lever, Fig 46.



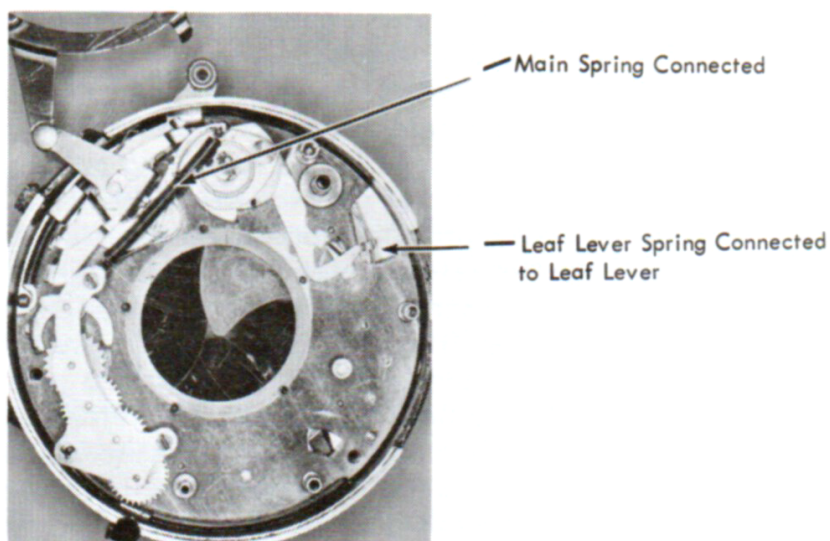


Figure 46

Set the shutter and (holding the time and bulb levers out of the way) test at this stage. Check the action on time and bulb by moving the release lever only a small amount at a time, or by slowing the action of the main lever by holding the setting lever.

With the shutter in the set position install the retard lever with its spring and screw, noting that both ends of the spring point to the left with the long end hooked over the leaf lever spring retaining nut.

Now release the shutter so it is in its rest position.

Next, the pallet control lever and the pallet can be placed in position on their posts. The pallet lever spring should tend to turn the pallet lever in a clockwise direction, and is installed as in Fig 47.

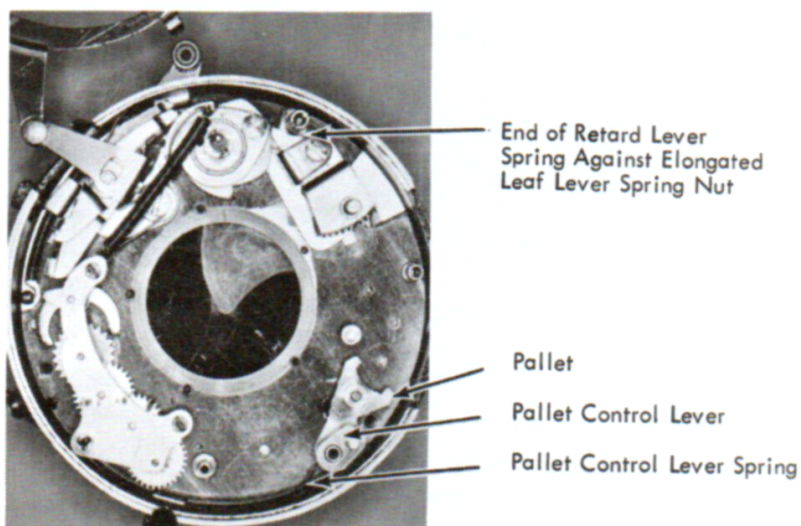


Figure 47

## COMPLEX ESCAPEMENT RETARD SHUTTER

Install the third gear, star wheel and the second gear of the retard train, in that order, Fig 48.

Replacement of the retard cover/first gear segment assembly involves timing or proper relationship between the retard lever and the gear segment as described in the following paragraphs.

With the shutter in the set position lower the retard cover/first gear segment assembly into the approximate position shown in figure 49. Install the two retard cover screws, but do not tighten them all the way down. The screws should be left loose enough to allow the retard cover to be lifted to disengage the first gear segment from the retard lever, but tight enough that the gear pivots will remain aligned with the bearing holes in the retard cover. Using the first finger of your left hand, lift and turn the first gear segment clockwise until it reaches the position shown in figure 50. Lower the gear segment to remesh it with the retard lever. It should still be in the same position shown in figure 50. Tighten the two retard cover plate screws and test the section by moving the retard lever in both directions. If the two levers are "timed", or properly engaged, the movement of the retard lever will be restricted in its counterclockwise direction by the shutter housing and in the clockwise movement by the relieved section of the first gear segment. If such is not the case, it will be necessary to again loosen the retard cover plate screws and reset the two gears by the method just described.

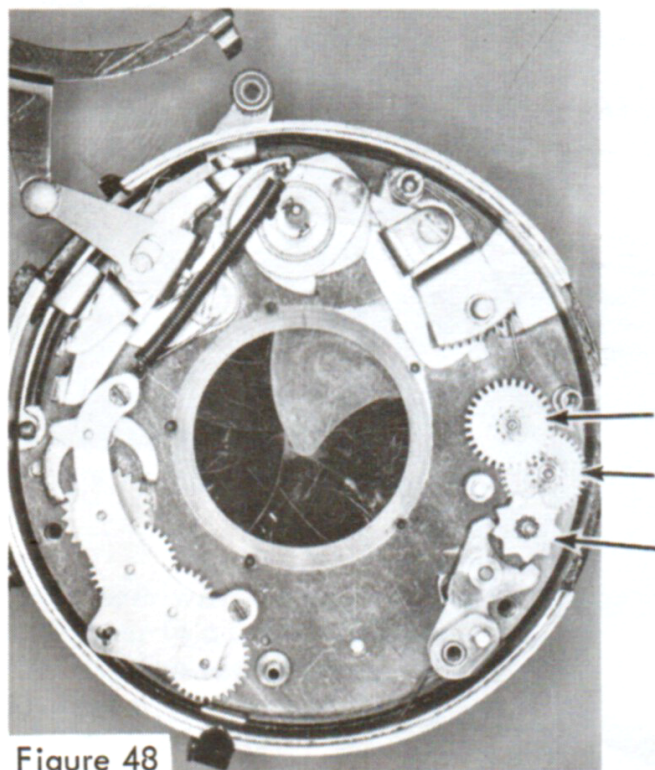
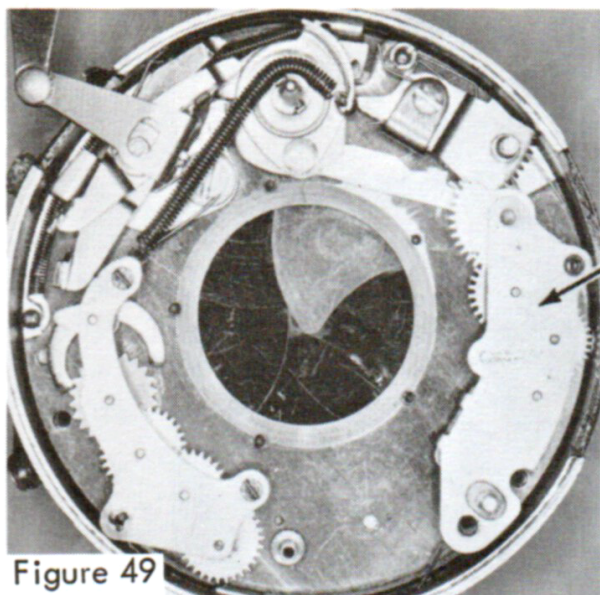


Figure 48

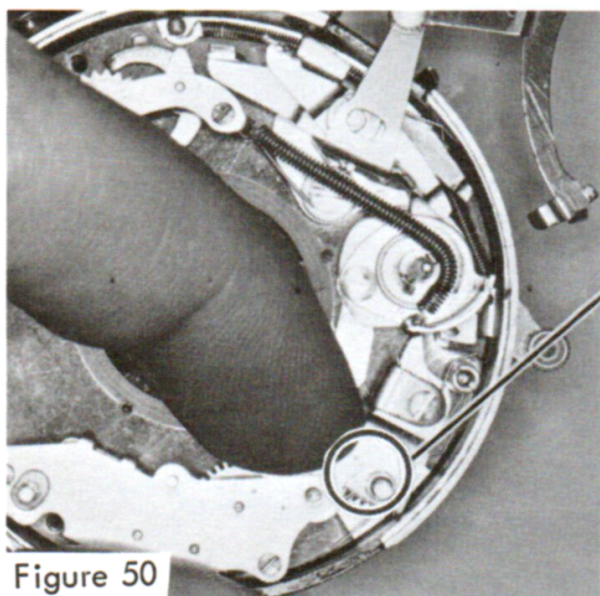
Second Gear  
Third Gear  
Star Wheel





Shutter in Set (cocked)  
Position

Retard Cover/First Gear  
Segment Assembly



Correct Timing Relationship  
between Retard Lever and  
First Gear Segment

**NOTE:**

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

If the timing is not correct, the shutter will either jam at the one-second setting, or give a short exposure. Test the shutter by holding the time and bulb levers out of the way. Operation should simulate one full second.

Now complete reassembly of the delayed-action gear train. Replace the clutch-pinion combination (second gear) as well as its small flathead retaining screw. Fit the first gear/spring assembly in its bearing hole with the long end of the spring against the delayed-action cover support post, Fig 51.

Install the high-speed spring, making certain that its straight end enters the hole next to the hub of the main lever, Fig 52.

## COMPLEX ESCAPEMENT RETARD SHUTTER

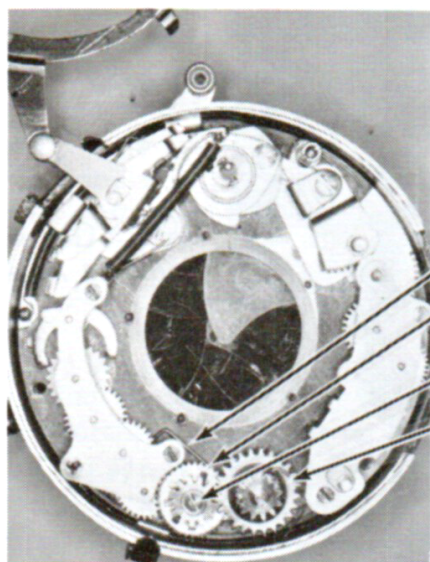


Figure 51

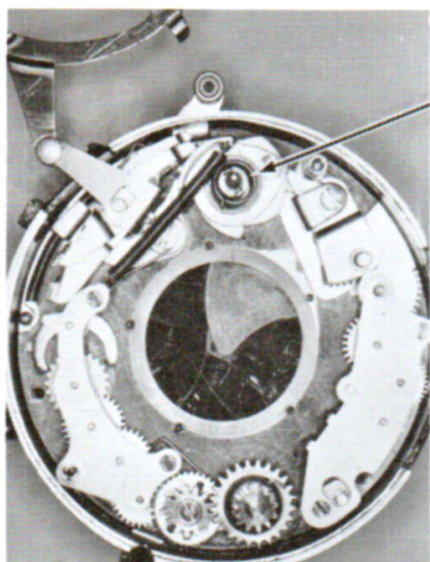


Figure 52

The shutter cover plate may now be added to the assembly. Be certain that the pivot of the delayed-action first gear fits into its bearing hole in the shutter cover plate. Replace the three screws in the shutter cover plate with the short one fitting into the hole at 1 o'clock, Fig 53.

Tripping the shutter at this point would yield a combination action of one second and time.

Using your tweezers, fit the delayed-action release lever by lifting and turning it in a counterclockwise direction so that it contacts the delayed-action pallet extension. Engage the delayed-action release lever spring as shown in figure 54. Do not move the release lever at this stage.



## PLACING THE INITIAL TENSION ON THE DELAYED-ACTION MECHANISM

With the thumb of your left hand, hold the delayed-action release lever away from the center of the shutter and operate the setting lever to cock the shutter.

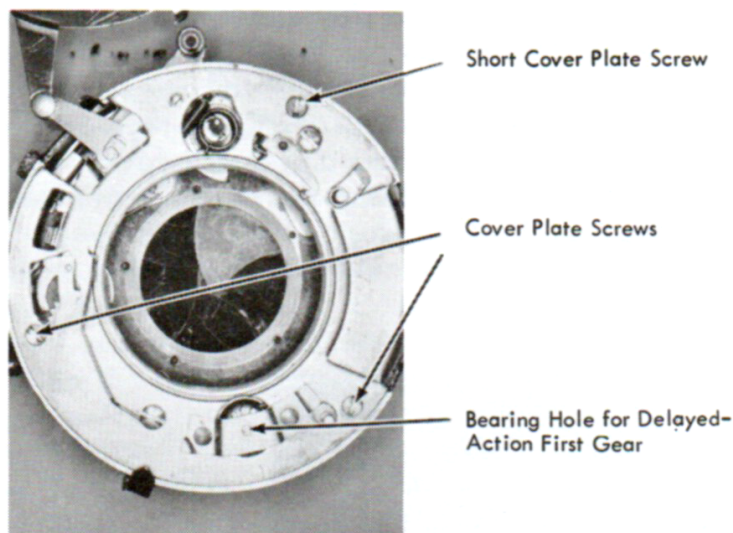


Figure 53

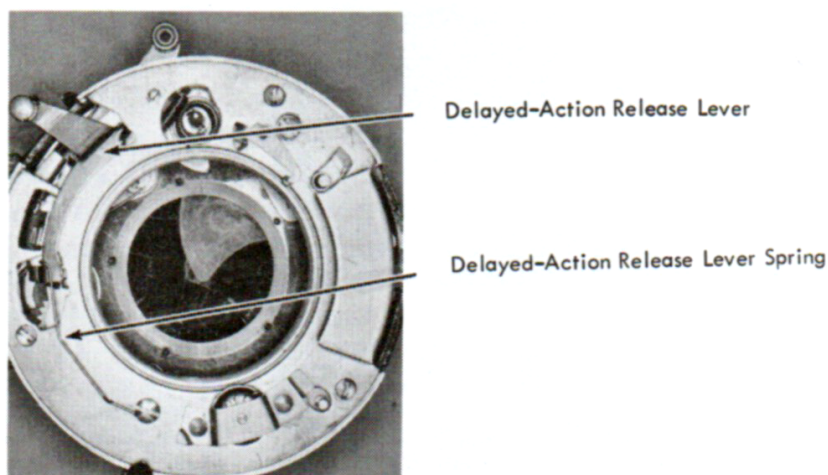
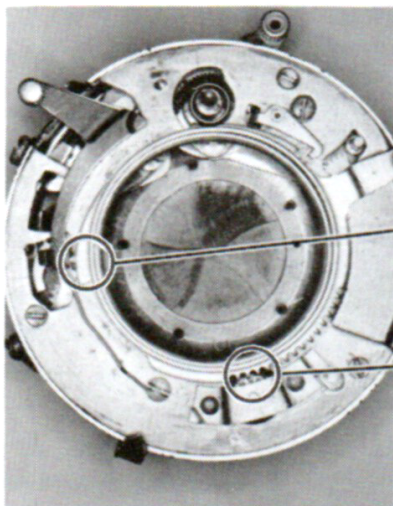


Figure 54

Lower the delayed-action setting lever at a slight angle, engaging it first with the delayed-action release lever, then allowing it to settle into position around the lens barrel engaging the teeth of the first gear of the delayed-action section. The delayed-action setting lever should now be in the position shown in figure 55 with the delayed-action release lever against (neither over nor under) the cam portion of the delayed-action setting lever. Hold the teeth of the delayed-action operating lever in constant engagement with the first gear of the delayed-action gear train and

## COMPLEX ESCAPEMENT RETARD SHUTTER

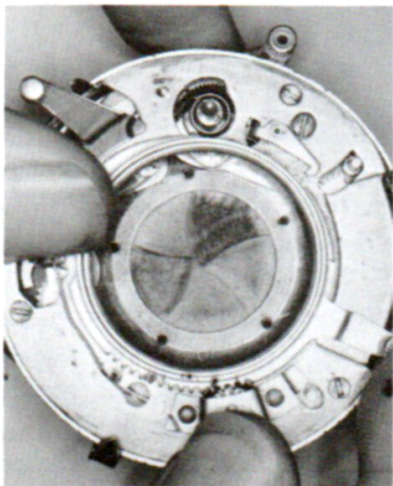
carefully wind the delayed action by moving the lever in a clockwise direction, until it occupies the position shown in figure 56. The delayed action should remain "cocked" at this position. (If the delay mechanism starts to unwind, it means the delayed-action release lever has moved out of position and is not contacting the pallet extension.) Carefully lift the delayed-action setting lever straight up and replace it over the lens barrel in the same position as shown in figure 55. The delay mechanism may start to unwind when the cam portion of the delay setting lever first contacts the delayed-action release lever so you will have to quickly engage the setting lever with the first gear. Once the delay setting lever is in position, the delayed-action release lever will settle back into its correct location and stop the pallet from vibrating. This procedure provides initial tension on the delayed-action spring. It will be tested after replacing the speed cam, nameplate, and retaining ring.



Cam Surface of Delayed-Action Setting Lever Against Delayed-Action Release Lever

Delayed-Action Setting Lever Meshed with First Gear

Figure 55



Delayed-Action Setting Lever in Set (cocked) Position

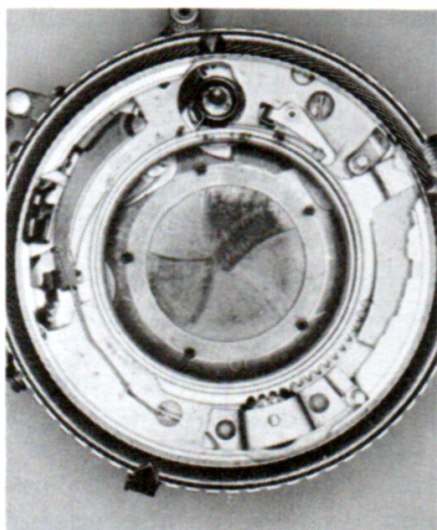
Figure 56



Trip the shutter (it should still deliver time action). Do not disturb the delayed-action setting lever. Install the speed cam at the time setting by gently lowering and sliding it under the curved handle of the delay setting lever as shown in figure 57. It may be necessary to rotate the speed cam slightly in a counterclockwise direction in order for it to fully seat.

Note: On Supermatic models without the speed cam stop screw on the shutter cover plate, the speed cam will have to be brought into position at the bulb setting. This will necessitate moving the speed cam against the time lever as it is slid into position.

Replace the high-speed cam, nameplate, and retaining ring. Test the shutter for proper operation at all speeds.



Speed Cam on  
Time Setting

Figure 57

With the shutter set at an intermediate speed -- perhaps 1/25 second -- cock the shutter and move the delayed-action setting lever clockwise as far as it will go. Now, release the shutter. The delayed-action setting lever will move back because of the tension on the delayed-action spring, until a lug on the delay setting lever contacts the delayed-action release lever, pulling it down and tripping the shutter. As the delay setting lever continues to move, it will pull the delayed-action release lever even further. Then, because of the shape of that part of the shutter cover plate, the delayed-action release lever will disengage from the delay setting lever and the release lever assembly will return to its normal position. Although not part of the assembly procedure, the retaining ring and cover plate can be removed for observation of this action. With the cover plate removed you must hold the delay setting lever down so it stays engaged with the first gear of the delayed-action gear train when setting the delayed action. If

## COMPLEX ESCAPEMENT RETARD SHUTTER

there is insufficient tension on the delayed-action spring there will not be enough power to trip the shutter and/or complete the cycle and allow the release lever to return. If that is the case, remove the speed cam and cock the shutter. Wind the delayed action only a small amount ( $10^{\circ}$ - $20^{\circ}$ ), and then replace the delayed-action setting lever again to the position shown in figure 55.

Replace the speed cam and retest the delayed-action mechanism. If the tension is now sufficient, replace the nameplate and retaining ring.

### THE FLASH-SYNCHRONIZED VERSION OF THE SUPERMATIC SHUTTER

When insufficient natural light is available to photograph a subject an artificial means of producing proper illumination is necessary. This is most easily accomplished through the use of the familiar flash bulb or electronic flash unit. You will learn many details of flash equipment later. In order to provide a method of firing a flash unit, a switch of some sort is necessary to complete the circuit to the unit. The switch can be located either inside or outside the shutter, but the inside or internal location is common in modern shutters. The internal switch usually consists of nothing more than a pair of contacts connected to a terminal on the outside of the shutter housing. The terminal provides an easy method to attach a connecting cord from the flash unit to the contacts inside the shutter. One or more parts of the shutter mechanism are used to close the contacts completing the circuit to the flash unit.

The time at which the contacts are closed in relation to the full open position of the shutter blades will classify the contacts into one of three different types. These contact types are designated as X, F, and M. The X contacts are closed just as the shutter blades reach full open. The F contacts close just before the shutter blades start to open. M contacts are closed approximately 18-20 milliseconds (1/50 sec.) before the blades reach full open requiring the actual releasing of the shutter to be delayed after contact is made. These variations in contact closure are necessary in order to "time" or "synchronize" the full-open action of the shutter to the peak brilliance of a particular flash bulb. Since a complete study of all types of flash bulbs and synchronization will be made later in your training, the theoretical phase of the subject will not be covered at this time. Our concern at the moment is in the contacts themselves and the parts that operate and control them.

The flash-synchronized version of the Supermatic shutter has all three contact types. The X contact is operated by a stud on the blade operating ring which closes the contact just as the blades reach full open. The F and M contacts are closed by a special



contact closing lever which is added to the mechanism. After contact is made the delay of the shutter release is achieved by a delayed-action mechanism which is similar in some respects to the one in the nonsynchronized Supermatics. The delayed-action setting lever, first gear with drive spring and second gear and clutch combination are identical, but the third, fourth, and fifth gears, star wheel and pallet are eliminated on the synchronized version. In place of the eliminated parts is a pinion and ratchet. Since the gear train has been shortened and the pallet removed the delay mechanism is considerably faster than in the nonsynchronized version. The operating time is a little less than 20 milliseconds (1/50 sec.)

The retard escapement pallet does not disengage during the setting stroke on some Flash Supermatic models. This is due to the design of the shutter setting lever which does not contact the pallet control lever stud under the mechanism plate when the shutter is cocked.

The Flash Supermatic shutter is easily handled when the operation, disassembly and timing of the nonsynchronized Supermatic are thoroughly understood. The function and initial tensioning of the delayed-action mechanism are especially critical.

Most Flash Supermatic shutters use a bayonet type nameplate, described earlier. Sometimes the nameplate will also contain a sync selector dial as shown in figure 58. DO NOT remove the slotted nut which holds the dial in position. Its function and purpose will be discussed later.

With the nameplate off you will note the similarity to the non-synchronized Supermatic, Fig 59. The terminology of the delayed-action parts have been changed to suit the purpose of the mechanism. The delayed-action setting lever is now called the synchronization or sync setting lever, the delayed action release lever (and spring) is now the sync release lever (and spring) and the delayed-action lock lever is called the sync lock lever. Notice the weighted pallet positioned at 7 o'clock in figure 59.

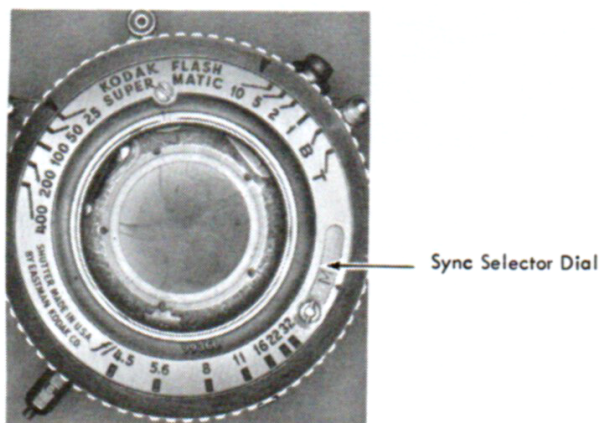


Figure 58

## COMPLEX ESCAPEMENT RETARD SHUTTER

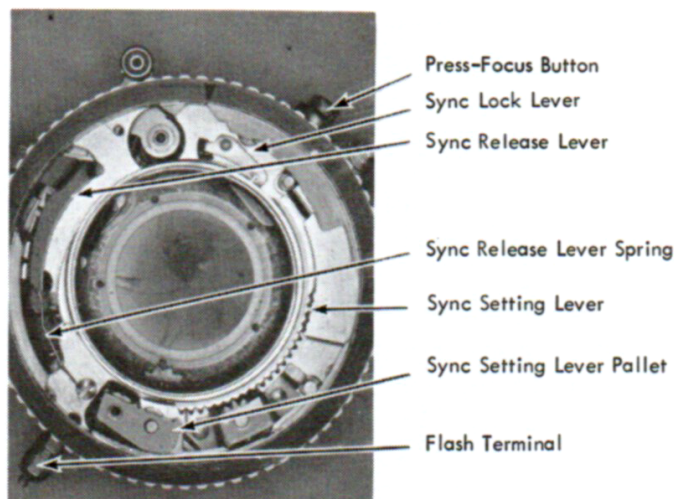


Figure 59

Just as in the nonsynchronized Supermatic, it is not advisable to operate the delay mechanism at this point in the disassembly. Simply make the following observation: The pallet engaged with the teeth of the sync setting lever helps to maintain smooth action of the setting lever on its return stroke.

Remove the speed cam and lift the sync setting lever and pallet off the shutter. Notice the "end" of a long lever riding against the sync release lever, Fig 60. This "tail" is the end of the contact closing lever and is important in its function.

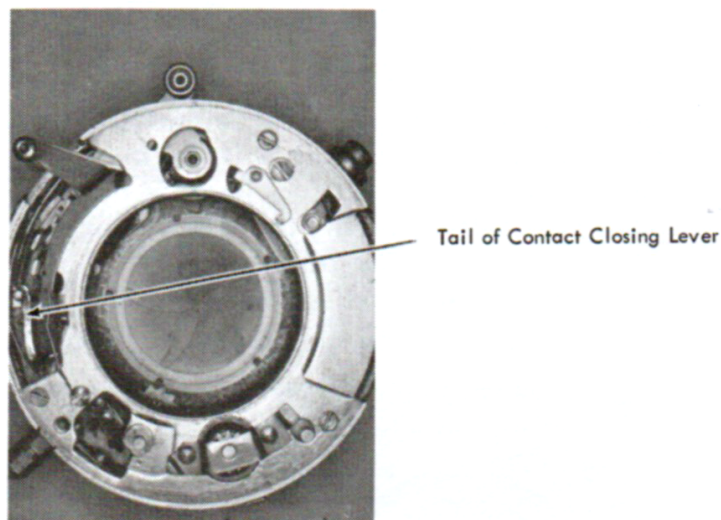


Figure 60

The contact end of the lever can be seen by looking into the shutter through an opening in the cover plate. The contact end of the lever includes a pawl which engages the ratchet of the sync delay gear train. As the sync release lever is depressed, the tail of the contact closing lever can move towards the center of the shutter. Pivoting, the contact end of the lever moves towards the



outside of the shutter. Simultaneously, the pawl of the contact closing lever disengages from the ratchet so the sync delay drive spring can turn the gear train.

Remove the high-speed cam and disconnect the sync release lever spring. Lift and turn the sync release lever away from the shutter in the same manner as described for the nonsynchronized Supermatic. Removal of the cover plate is also accomplished in the same manner.

The contacts and sync mechanism parts are now visible, Fig 61. Using tweezers, move the tail of the contact closing lever back and forth. Note that the contact lever is an assembly. The pawl is attached to and pivoting underneath the main or contact por-

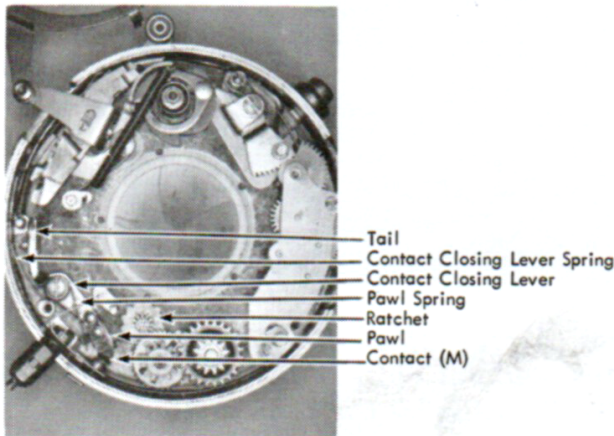


Figure 61

tion of the lever. The pawl is also spring-loaded to allow over-travel of the rest of the contact closing lever after the pawl engages the ratchet. The upper spring provides tension for the entire lever to keep the contact end towards the outside of the shutter. Also note that when the tail of the lever is held towards the outside of the shutter housing, the pawl is engaged with the ratchet, Fig 62. This is the normal position of the contact closing lever in the fully assembled shutter.

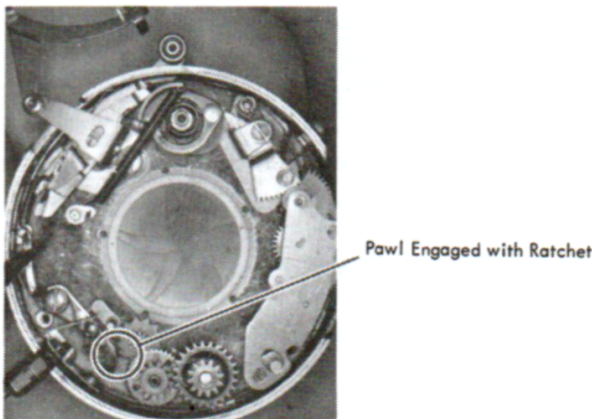


Figure 62

## COMPLEX ESCAPEMENT RETARD SHUTTER

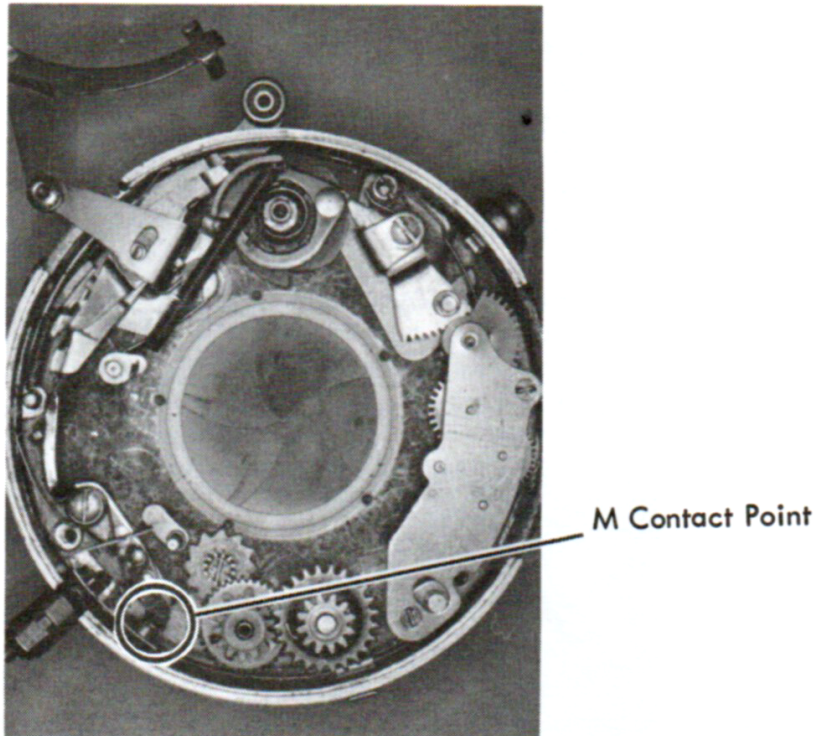


Figure 63

Here's a brief description of the sync delay section function:

The tail of the contact closing lever is held towards the outside of the shutter housing by the sync release lever. This keeps the contact closing lever pawl engaged with the sync delay mechanism ratchet. The pawl remains engaged with the ratchet whenever the shutter is operated without winding the sync delay mechanism.

The contact closing lever pawl can only disengage from the sync delay ratchet if the shutter is released when the sync delay setting lever is in its set or wound position. When the sync setting lever is wound, the sync release lever can swing towards the center of the shutter as the release lever is depressed. Once there, the sync release lever is held by a cutout in the cover plate like that in the nonsynchronized version. The contact closing lever tail can then follow the sync release lever, pivoting the other end of the lever towards the outside of the shutter. Electrical contact is made at the point circled in figure 63 as the pawl disengages from the ratchet. Pawl disengagement frees the sync delay mechanism allowing the sync delay setting lever to rotate towards its unwound position. Just before it completes rotation, a lug on the sync setting lever picks up the sync release lever, moving it far enough to trip the shutter.

The fundamental difference between sync and nonsynchronized Supermatic delay mechanisms is that the sync action occurs in just a fraction of a second. The time interval between the closing of



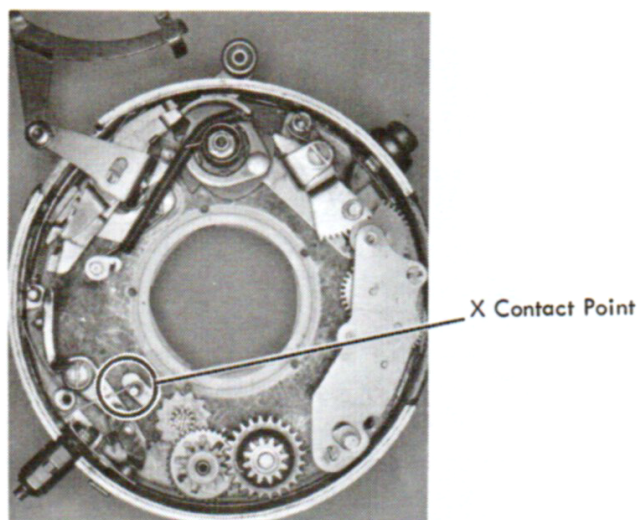


Figure 64

the contact, Fig 63, to the full-open position of the shutter blades is approximately 20 milliseconds. The contact closing lever is an M contact. When the blades are full open, Fig 64, **X contact is made at the other end of the contact strip by the stud on the blade operating ring.** When the sync setting lever is not wound, the sync release lever can't move towards the center of the shutter when the release lever is depressed. Thus, the contact closing lever can't complete its M contact. Electrical contact will only be made by the blade operating ring stud when the blades reach their full-open position.

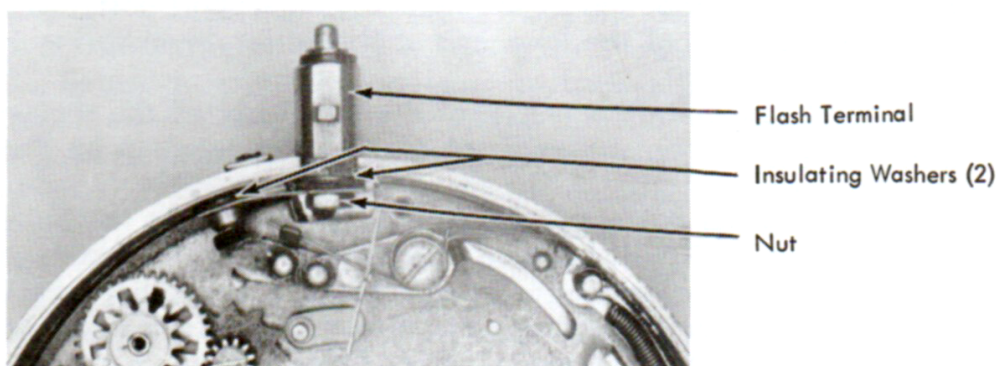


Figure 65

## COMPLEX ESCAPEMENT RETARD SHUTTER

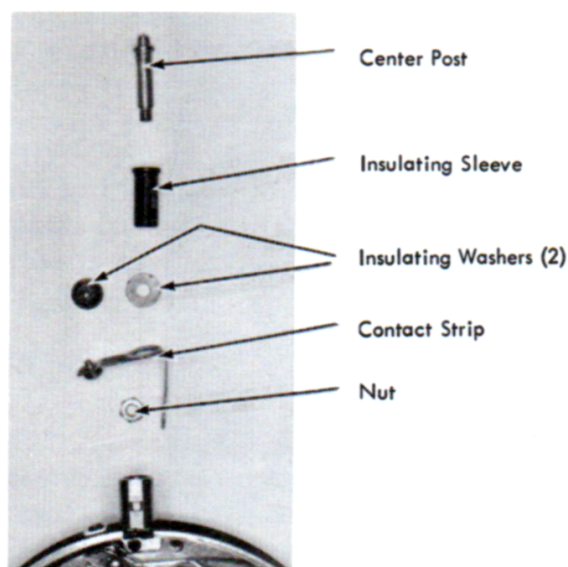


Figure 66

The electrical switch circuit in the Flash Supermatic is a type in which the entire shutter is grounded to the sync terminal. This means that any part of the shutter can become a "ground" contact. Thus, the blade operating ring stud is the ground contact for X and the contact closing lever is the ground for M. Naturally, this requires that the contact strip be completely insulated from the shutter housing. Notice the insulating washers in figure 65. The contact strip is held to the flash terminal center post (which is also insulated from the outer shell of the terminal) by the nut shown in figure 65. Removal of the nut allows disassembly of the various parts of the contact assembly seen in figure 66.

Disconnect and remove the contact closing lever spring. The pawl spring need not be disconnected. Remove the contact closing lever screw and lift the lever from its pivot post.

Note that the long end of the sync delay drive spring is placed against the bottom shoulder of the second gear support post. Also observe the position of the long end of the pallet lever spring in the retard escapement.

The operation and disassembly of the remainder of the shutter is identical to the nonsynchronized version and need not be discussed further.

After the shutter has been reassembled and tested to the point shown in figure 60 it will be necessary to place initial tension on the sync delay drive spring. The procedure follows that of the nonsynchronized delayed-action mechanism except for the following differences. Instead of one wind of initial tension on the setting lever before testing, one and one-half winds are applied. This means that after you place the first turn of tension, lift and replace the setting lever back in its rest position. Then wind it again, but only one-half its normal amount. Again lift and re-



place the setting lever in its unwound position. Assemble the speed cam and cover plate and test for proper action. The sync delay should run through smoothly, tripping the shutter at the end of its travel.

In models having a sync selector dial in the cover plate, a choice of M or F synchronization is provided. For M synchronization the red M on the dial should be lined up with the red arrow on the nameplate. If F synchronization is desired, the dial can be moved to the right until the red F lines up with the arrow. The retaining nut holding the dial in position must be loosened and re-tightened each time the dial position is changed. When the dial is in the F position, the sync setting lever movement is restricted by a lug on the underside of the dial plate. With the sync setting lever wound and released in this position a short delay of 2 or 3 milliseconds occurs before the shutter is tripped. This brief delay time provides F synchronization. Contact is made by the contact closing lever, but the running time of the sync delay mechanism is so short before the blades start to open that the contact closing lever becomes an F instead of M contact.

This is the point at which the exact synchronization delay time would ordinarily be tested with electronic test equipment. If the delay time is too long, additional tension would be placed on the drive spring. If too short, some of the tension would be removed. Synchronization testing and adjusting procedures will be covered in later texts.

Note: Some variation may be noted in the location of the flash terminal on the shutter housing. The position is determined mainly by the design of the particular camera on which the shutter is used. Regardless of where the terminal is located on the outside of the housing, the internal parts will remain in the same position, with only minor variations in the length of the contact strip and the shape of the contact closing lever.

Another version of the synchronized Supermatic shutter is called the "X Supermatic". In this model no delay mechanism of any type is used. X contact is provided just as in the Flash Supermatic, but the sync release lever, sync setting lever, contact closing lever, ratchet, and all sync delay gearing are missing.

## THE KODAMATIC AND DIOMATIC SHUTTERS

The Kodamatic and Diomatic (this shutter is not to be confused with a vintage model dial-set Diomatic which is of entirely different design!) shutters are simplified versions of the Supermatic. The Kodamatic shutter is identical to the Supermatic except for the

## COMPLEX ESCAPEMENT RETARD SHUTTER

elimination of the high-speed spring and a simplified (shorter) retard escapement. The omission and simplification of these parts will naturally result in a narrower speed range, delivering from 1/200 sec. to 1/10 sec., B and sometimes T. Like the Supermatic shutter you'll find both synchronized and nonsynchronized models. The delay mechanisms of both types are identical to their Supermatic counterparts.

The Diomatic shutter contains only basic parts completely eliminating a delay mechanism or synchronization of any type. The high-speed spring is missing as are the star wheel and pallet in the retard gear train. The star wheel and pallet are replaced by a fly-wheel weight, not unlike that in the Vario shutter gear train.

## THE MULTIPLE-SPEED CAMS OF THE DIAL-SET COMPUR SHUTTER

You have learned that early models of the Compur shutter avoided the use of a single, complex speed cam to control the various functioning parts of the shutter. Instead, several speed cams are used, each controlling a different section of the shutter.

Thus, one speed cam is used to control time, bulb and instantaneous action. It is necessary to set the cam for the particular action desired. Two more speed cams are set simultaneously with a dial at the top of the shutter; one controls the amount of retard action and the other, pallet movement. Thus, with the time-bulb-instantaneous speed cam set at "instantaneous", the exposure obtained depends on the setting of the speed control disc, which moves both the retard adjusting cam and the pallet adjusting cam.

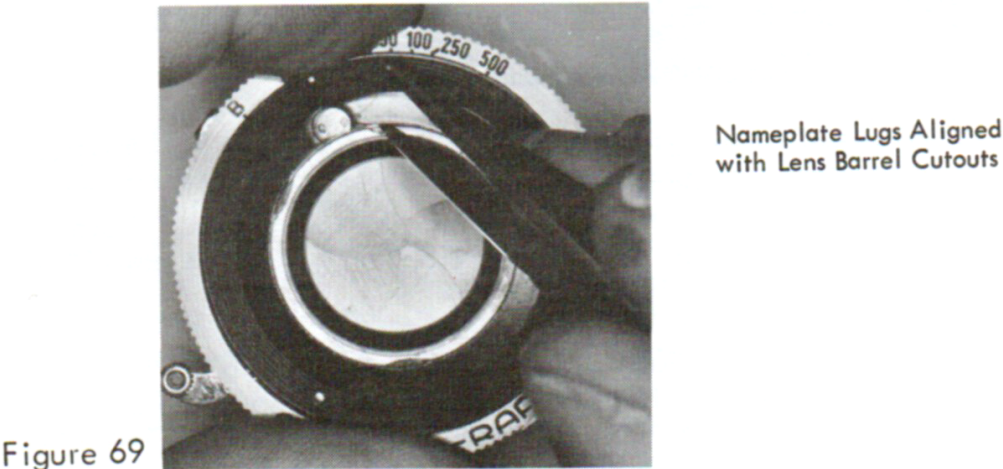
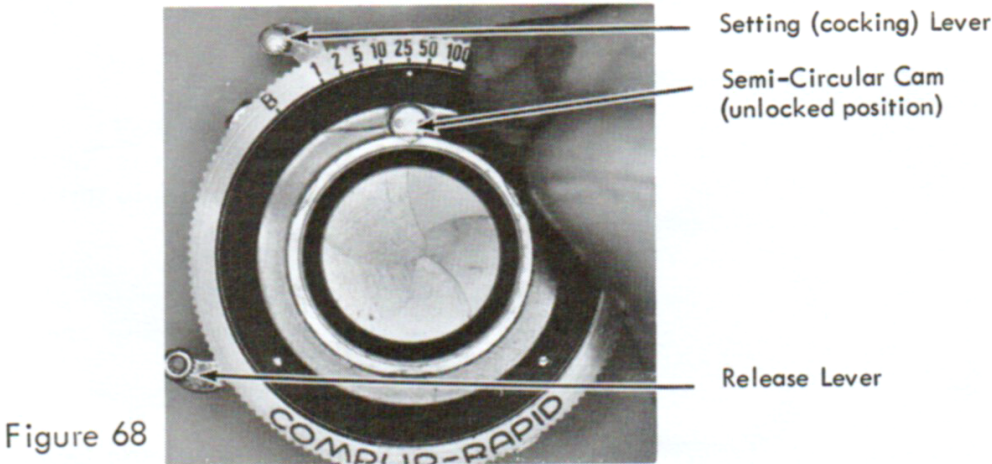
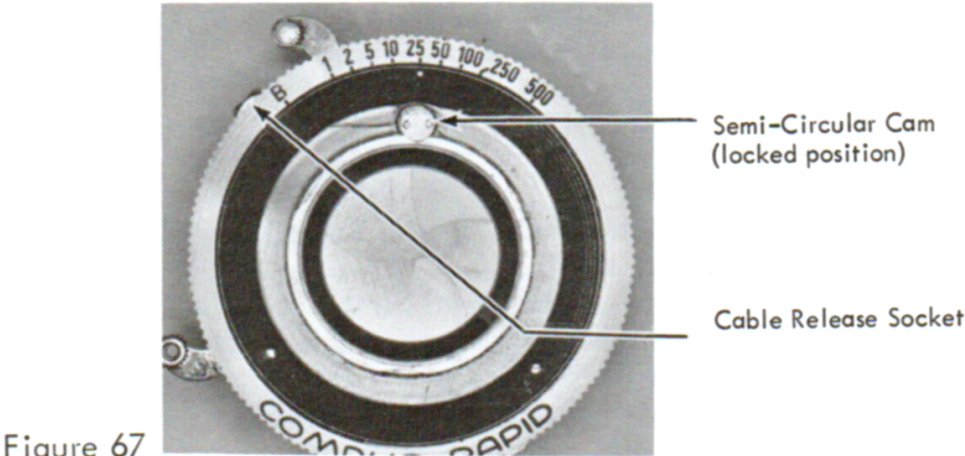
As mentioned earlier in your lessons, the dial-set Compur shutter (as well as certain models of the rim-set Compur shutter) functions as an automatic shutter when operated on time or bulb, but as a set-and-release type shutter when used at instantaneous speeds. When the "T-B-I" dial is set for "time" or "bulb" in the dial-set Compur shutter, it is impossible to operate the setting lever. This is because a lever is moved into position to prevent movement of the dial-set Compur shutter's main lever unless set on "I".

## DISASSEMBLY OF THE RIM-SET COMPUR-RAPID SHUTTER

The nameplate of the Compur-Rapid shutter is a bayonet-type with three lugs engaging a groove on the outside of the lens barrel. Rotation is prevented by a semi-circular cam turned to nest in a half-moon cutout at 12 o'clock on the outside of the lens barrel, Fig 67. By rotating the cam 180° so that the semi-circular section points to the outside of the shutter, Fig 68, it is possible to turn the nameplate in a counterclockwise direction. When the



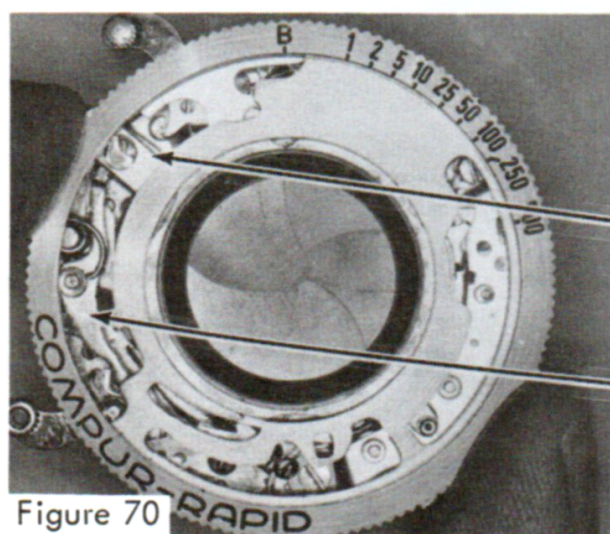
lugs on the nameplate are aligned with relief clearances on the outside of the lens barrel—the plate may be lifted as shown in Fig 69.



## COMPLEX ESCAPEMENT RETARD SHUTTER

On some models the semi-circular locking cam may be covered by an additional plate (usually containing the name of the camera manufacturer using the shutter) which is held in place by two screws. Removal of one screw and loosening of the second will permit the plate to be swung out of the way revealing the locking cam.

On other models, usually in the larger sizes, and older versions, the locking cam is not used. Instead, a screw which passes through the nameplate into the mechanism prevents the plate from turning. This locking screw (at approximately 5 o'clock) is usually covered by a diaphragm calibration scale fastened on the bottom half of the nameplate by two screws. Partial removal of the scale will reveal the locking screw.



Speed Cam at  
Maximum Clockwise  
Position (bulb setting)

Internal Portion of  
Cable Release Socket

Cable Release Lever

Figure 70

Be careful to avoid disturbing the speed cam when lifting off the nameplate. Many of the functioning parts of the shutter can be observed through the openings in the speed cam. Rotate the speed cam clockwise as far as it will go, holding it down firmly, Fig 70.

Note: The following description of bulb lever operation applies to the Compur and Compur-Rapid shutters with set-and-release bulb action. On



Compur models with automatic T and B action refer to the section "VARIATIONS IN THE COMPUR RIM-SET SHUTTER - Automatic Time and Bulb Action".

Setting and releasing the shutter will now give bulb operation. Find the long lever which extends from the release lever up to the cable release socket at approximately 10 o'clock. This is the cable release lever. Primarily, it provides a linkage between the cable release socket and the release lever to permit releasing of the shutter with a cable release. The cable release lever is spring tensioned and in constant engagement with the release lever, and so controls the action of the release lever which has no spring of its own. A secondary, but important function of the cable release lever is its control over the action of the bulb lever. Using the first finger of your right hand, set the shutter and then allow the setting lever to return slowly after releasing the shutter with the other hand. Observe how the cable release lever governs the bulb lever action via the lug on the right end of the bulb lever, Fig 71, which comes under, then up against the cable release lever. When the release lever is depressed, the cable release socket end of the cable release lever moves towards the center of the shutter, allowing the bulb lever to move into engagement with the main lever

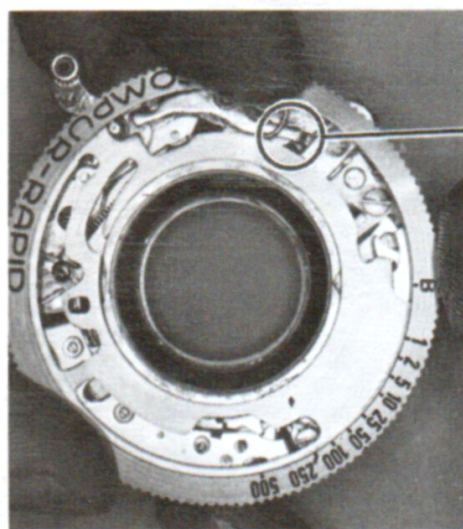


Figure 71

Cable Release Lever Controls Bulb Lever Movement at This Point.

**Note:**

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

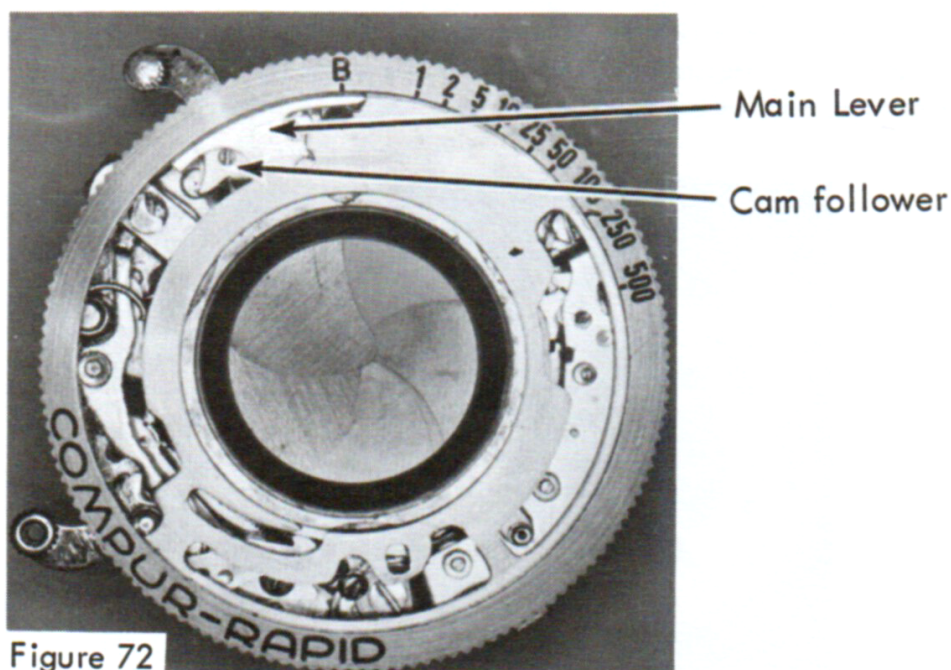
for bulb action. When the lever system is allowed to return, the cable release lever picks up the bulb lever, moving it out of engagement with the main lever to complete the cycle.

Some Compur-Rapid models will not contain a cable release socket, yet retain the cable re-

## COMPLEX ESCAPEMENT RETARD SHUTTER

lease lever. And other models, both with and without cable release sockets will use a bulb and cable release lever of slightly different design from the one previously discussed. However, the differences are minor and you should have no difficulty in analyzing the operation.

The setting lever is but an extension of the main lever, which is a full ring circling the lens barrel under the speed cam. Direct your attention to the area of the main lever where the setting lever passes under the speed cam. Directly underneath and assembled to the main lever is the cam follower lever, Fig 72. This is the part of the main lever assembly which operates the leaf lever. With the speed cam still set on bulb, slowly cock the shutter. Discover the bell crank-shaped lever between the cam follower and the cable release lever, Fig 73. This is the leaf lever. Reach through the



speed cam with a small screwdriver or pick and gently move the leaf lever in a counterclockwise direction, opening the blades, Fig 74. The leaf lever spring will return the blades to the closed position when the tool is removed. Restrain the setting lever and release the shutter. Allowing the setting lever to return slowly will help you to see how the cam follower operates the leaf lever.



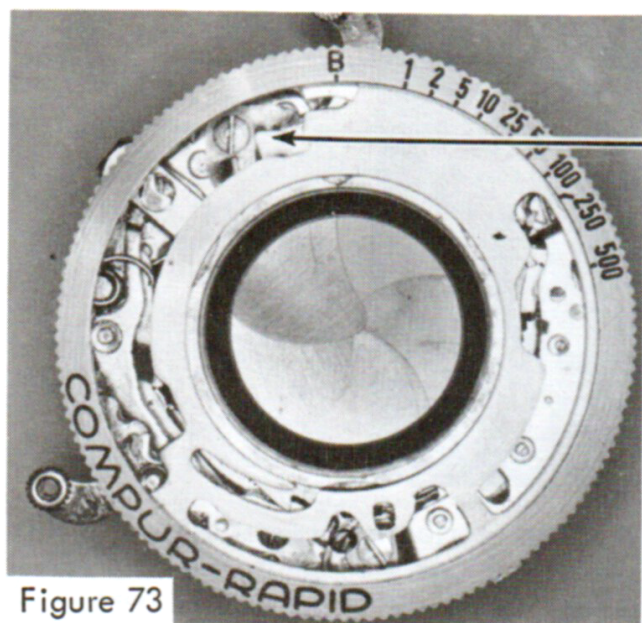


Figure 73

Leaf Lever

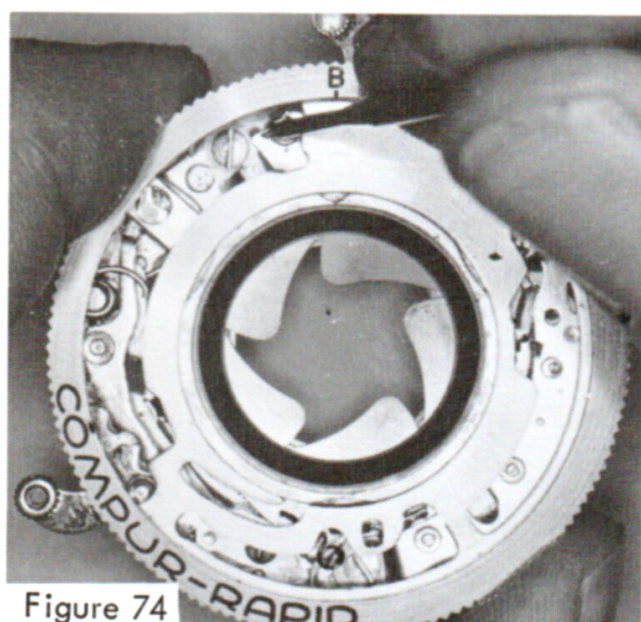
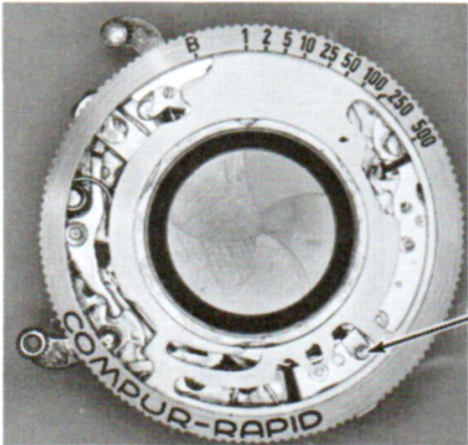


Figure 74

Shutter Blades  
Partially Opened  
Via Movement of  
Leaf Lever

Use the nameplate locking cam cutout on the lens barrel as a reference point. Move the speed cam to the one-second setting, Fig 75. Now set and release the shutter several times. The lever at 4 o'clock which moves back and forth when the shutter is set and released is the retard lever, Fig 75. The retard section extends from just below this point up to approximately 2 o'clock. Restrain the movement of the setting (main) lever when the shutter is released so you can see how the retard lever is pushed back after the blades fully open.

**COMPLEX ESCAPEMENT RETARD SHUTTER**

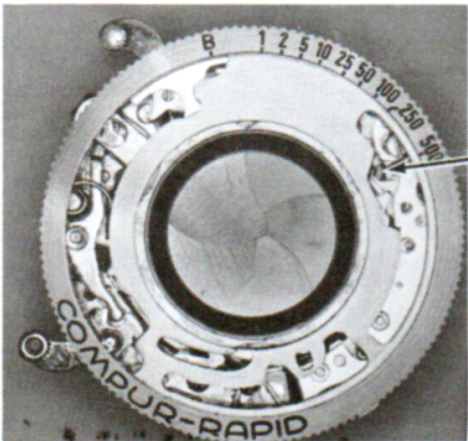


Speed Cam  
at One-Second  
Setting

Retard Lever

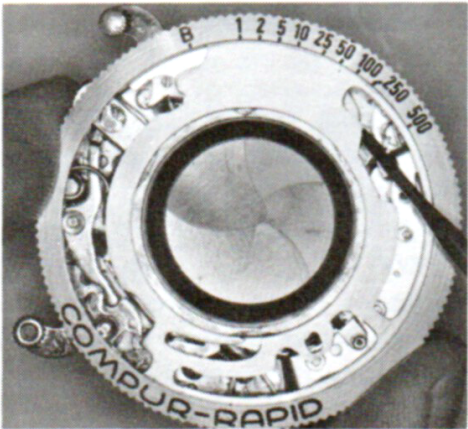
Figure 75

At the other end of the retard section is a lever which contacts both the main lever and the speed cam through a curved projection. This is the pallet lever, Fig 76. With the shutter in the released (rest) position, it is possible to move the pallet lever towards the outside of the shutter with a small screwdriver, Fig 77. When the pallet lever is pushed toward the outside of the housing, the



Pallet Lever

Figure 76



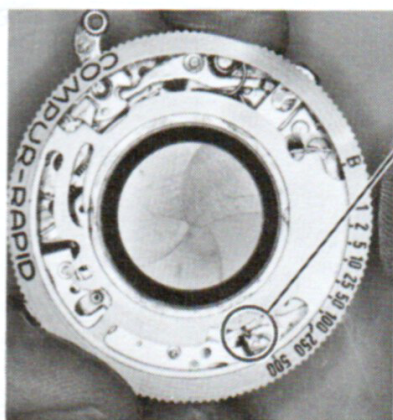
Pallet Lever Pushed  
Towards Outside of  
Shutter Housing

Figure 77



pallet is disengaged from the star wheel. During the actual setting of the shutter, a cam-like section of the main lever pushes the pallet out of engagement, Fig 78, so the retard lever may move easily to its set, or ready, position. The reason for disengaging the pallet during the setting stroke becomes apparent when you operate a shutter that does not disengage the pallet during the setting stroke. (Some models of the Flash Supermatic are good examples.) When setting shutters of this type, the entire escapement is in operation as the retard lever moves to its ready position. Since the only power available to move the retard section to the ready position is provided by the tension of a relatively weak retard lever spring, the action is quite slow. In fact, if the shutter is set rapidly, the retard lever may be still moving into position 2 or 3 seconds after the shutter has been set. In shutters designed to disengage the pallet during the setting stroke, the tension of the retard lever spring need only overcome the inertia of the gear train, and the retard lever will move into position as the setting lever stroke is completed. When the shutter is released with the setting lever restrained, you can see the pallet lever move towards the center of the shutter, engaging the pallet as the main lever contacts the retard lever, Fig 79.

Figure 78



Cam-like Portion of Main Lever Pushing Pallet Lever towards Outside of Shutter Housing During Setting Stroke.

Note:  
"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

Figure 79

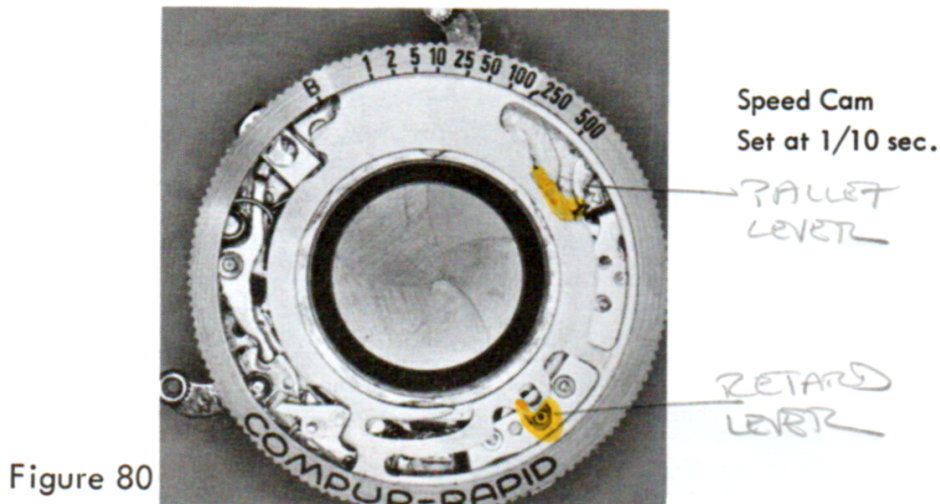


Shutter in Partially Released Position with Shutter Blades Wide Open. Pallet Engaged and Main Lever Just Coming into Contact with Retard Lever.

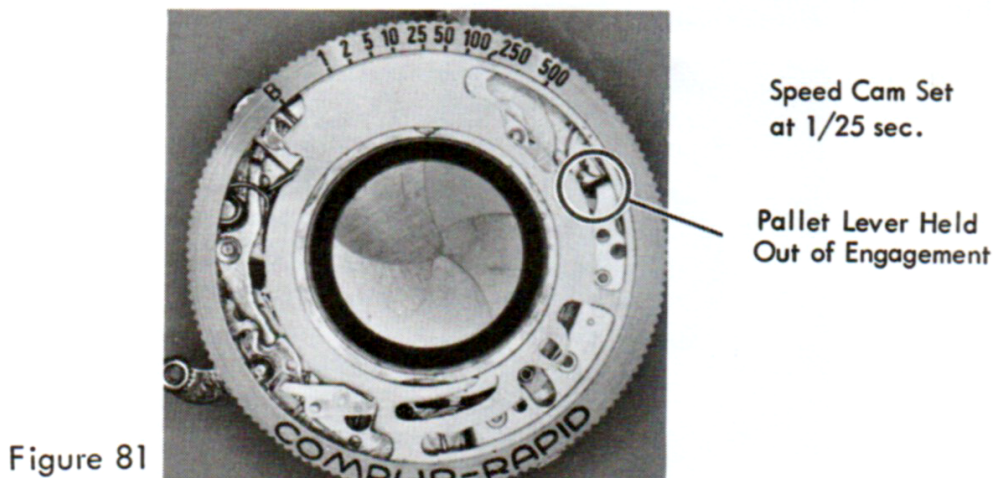
Note:  
"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

## COMPLEX ESCAPEMENT RETARD SHUTTER

At the one-second setting the retard lever moves into a deep valley cut in the speed cam. As the speed cam is rotated to the 1/2 second position the retard lever cannot move as far, which means a shorter exposure with less retard gear train movement. Similar control has been seen in other shutters, and you will find that the movement of the retard decreases as the speed cam is rotated, one speed setting at a time, from 1 second to 1/10 second. At 1/10 second there is a minimum movement of the retard lever, Fig 80, but full pallet engagement takes place when the shutter is released.



Moving the speed cam one more setting, to 1/25 second, brings a new valley into position to receive the retard lever. But now, a projection on the speed cam has contacted the pallet lever holding it toward the outside of the shutter, Fig 81. Trip the shutter a few times at this setting and you will see that, although the retard lever has a large relative movement, exposure duration is compara-





tively brief because only the inertia of the gear train retards the movement of the main lever (the pallet is completely disengaged). Further rotation of the speed cam decreases the movement of the retard lever by increments until, at the next-to-highest speed setting (1/250 second or 1/100 second on some models) there is no movement of the retard lever, no retard action on the main lever, and the shutter is operating as fast as possible under the tension of the main lever spring.

Movement of the speed cam to the highest speed setting permits the engagement of the free end of the high-speed spring (between 10 and 11 o'clock) with a milled section of the speed cam, Fig 82.

Note: **NEVER** move the speed cam to the highest speed setting with the shutter in the set (cocked) position.

The lower end of the high-speed spring is engaged with a lug on the main lever. Setting of the shutter will now put two springs under tension. In addition to that of the main spring, there is the pressure of the high-speed spring, which is held in tension by the speed cam. With both springs under tension, the speed at which the main lever travels is doubled when the shutter is released.

Set the speed cam at 1/50 second to easily observe the action of the inner release lever. Cock the shutter slowly and watch the lever under the speed cam at 7 o'clock, Fig 83. This lever, which employs a seesaw motion during the setting of the shutter, is the inner release lever and engages a notch on the main lever when the shutter reaches its full set position. Moving the outer release

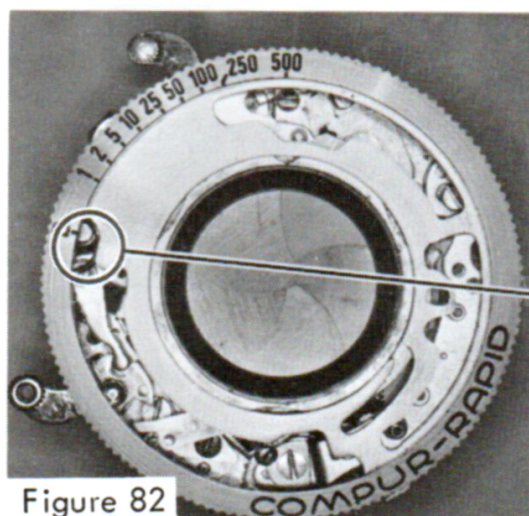
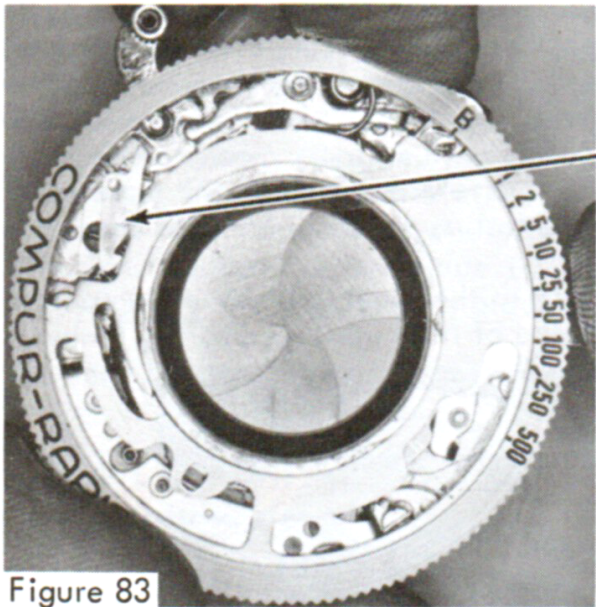


Figure 82

Speed Cam Set  
at 1/500 sec.

High-Speed Spring  
Engaged by Speed Cam

**COMPLEX ESCAPEMENT RETARD SHUTTER**

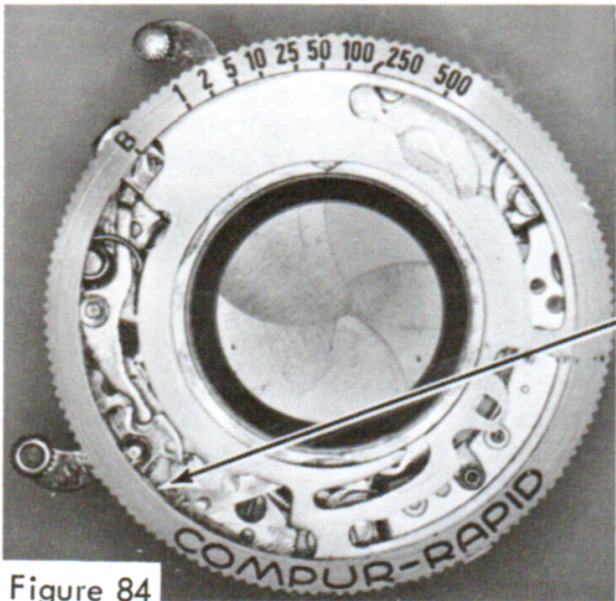


Inner Release Lever

Note:  
"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

Figure 83

lever in turn disengages the inner release lever from that notch permitting the main lever to return to its rest position. With the shutter in the released position, a depression in the surface of the main lever allows the latching end of the inner release lever to move towards the center of the shutter. This brings the other end of the inner release lever into such a position as to restrict the movement of the outer release lever, Fig 84. When the shutter is set, Fig 83, the shape of the main lever positions the inner release lever so the outer release lever is free to move.



End of Inner  
Release Lever  
Prevents  
Movement  
of Outer  
Release Lever

Figure 84



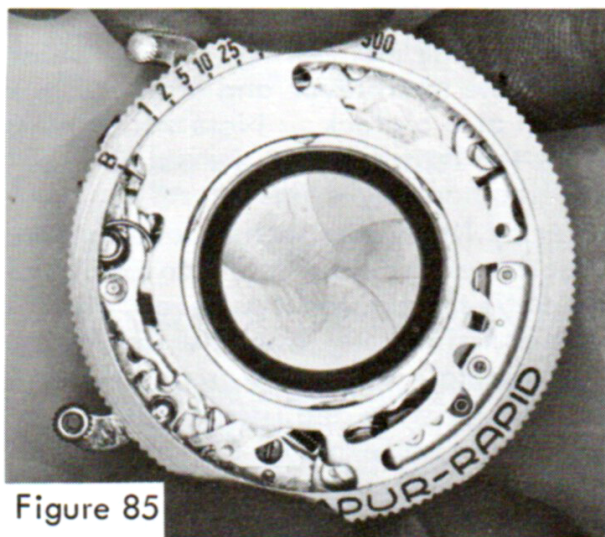


Figure 85

Before proceeding with the next phase of disassembly make sure the shutter is in the released (rest) position. If the diaphragm pointer is a two-part assembly (this varies depending on model) remove the screw attaching the diaphragm pointer to the diaphragm operating ring.

Being careful not to disturb the main lever, rotate the speed cam slightly in both directions as it is worked up off the lens barrel, Fig 85.

**CAUTION! DO NOT** attempt to set the shutter at this time with the speed cam removed. Orient your shutter once again with the nameplate locking cam cutout positioned at 12 o'clock. Locate and identify the various parts of the shutter which have already been described, Fig. 86.

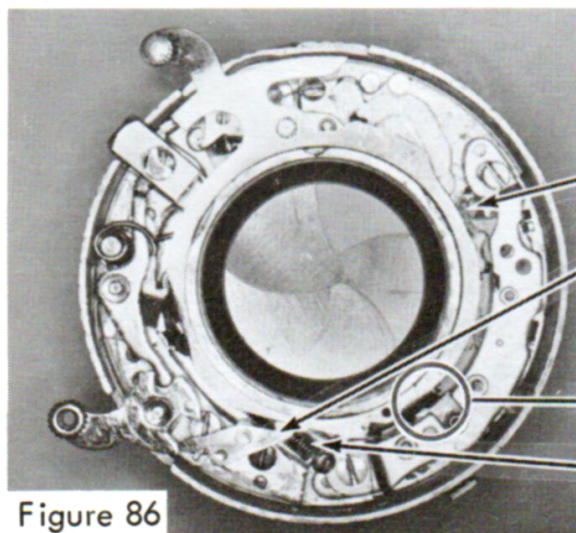


Figure 86

Pallet Lever

Inner Release Lever

Main Lever Lug Which  
Contacts Retard Lever

Main Spring

## COMPLEX ESCAPEMENT RETARD SHUTTER

Locate the lug on the main lever which is now in contact with the retard lever. Find the tension-type mainspring, part of which can be seen coming from under the main lever and attached to a stud at the end of the gear train at 6 o'clock. Note which parts ride against the main lever -- the retard lever, the pallet lever, and the inner release lever.

Now remove the main lever by lifting the setting lever handle slightly and then allow the tension of the main spring to rotate the main lever counterclockwise until the tension is relieved, Fig 87. Using tweezers, disconnect the main spring from the stud at the end of the gear train, then lift the main lever from around the lens barrel by using a gentle, but firm twisting and lifting motion.

Turn over the main lever assembly and examine the cam follower and the notches and lugs that contact the various parts in the shutter, Fig 88. The milled cam area of the mechanism plate which controls the cam follower movement can also be seen at this time, Fig 89.

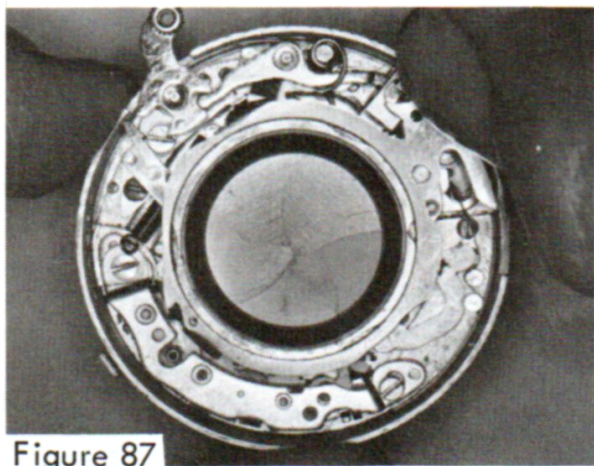


Figure 87

### Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

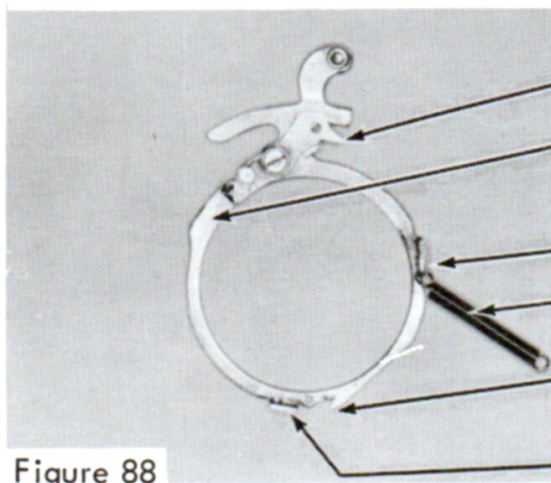


Figure 88

Cam Follower

Pallet Lever Lobe

Bulb Lever Lug

Main Spring

Inner Release Lever  
Latching Notch

Retard Lever Lug



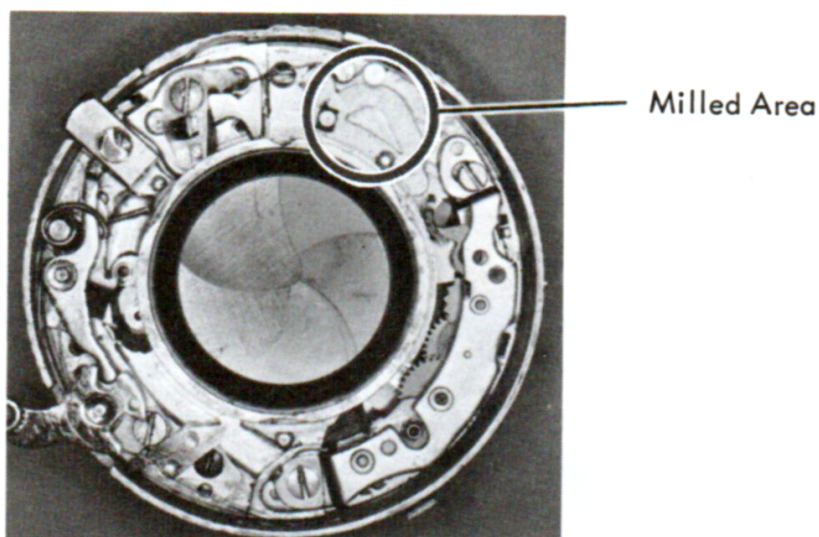


Figure 89

### HOW SIMPLE IS COMPLEX?

You can now see what appears to be quite a jumble of mechanism, Fig 90. However, you already know the function of the various parts and disassembly of the Compur shutter is the ultimate in simplicity. You will find it impossible to lose Compur shutter springs because each spring is firmly anchored to the part which it operates.

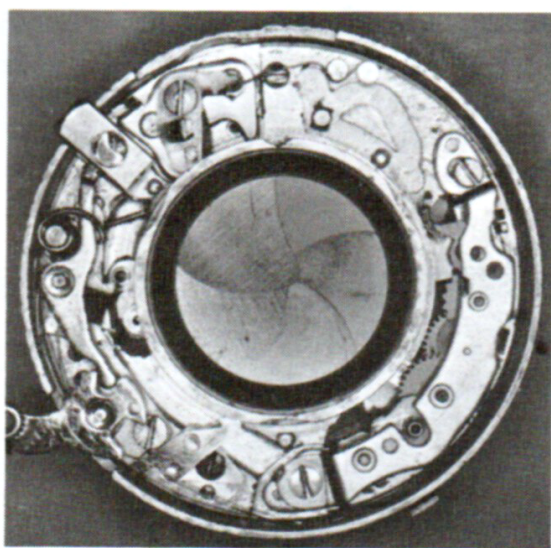


Figure 90

The only caution required is to observe the direction in which springs are engaged and even this is usually obvious.

Depress the release lever and reach through the hole in the cable release socket with a screwdriver to loosen the screw holding

## COMPLEX ESCAPEMENT RETARD SHUTTER

it to the mechanism plate. Using tweezers, lift and slide the cable release socket (with the screw still in place, but unattached to the mechanism plate) from the shutter.

Disassemble the cable release lever by first depressing the release lever. Then gently pry the cable release lever off its post with a small screwdriver placed under the pivot point of the lever, Fig 91.

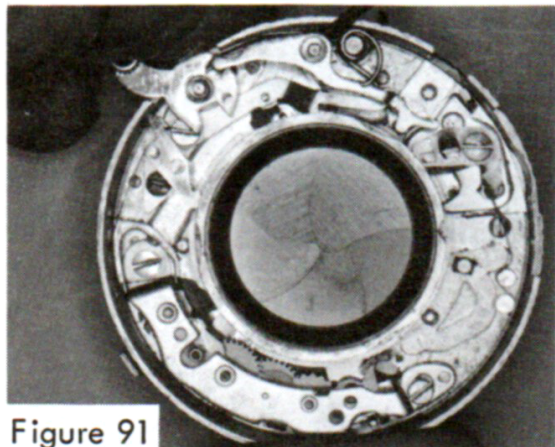


Figure 91

Removing the  
Cable Release  
Lever

Note:

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

Lift the release lever from its post and then note the position of the bulb lever spring, Fig 92. Grasp the spring with your tweezers and gently lift the spring over the cable release lever post and let it rest against the side of the shutter housing. Unscrew the bulb lever screw and remove the screw and the bulb lever with its spring. The inner release lever is held in place by a single screw in its mounting block. The block, inner release lever and spring come out together after removal of the screw.

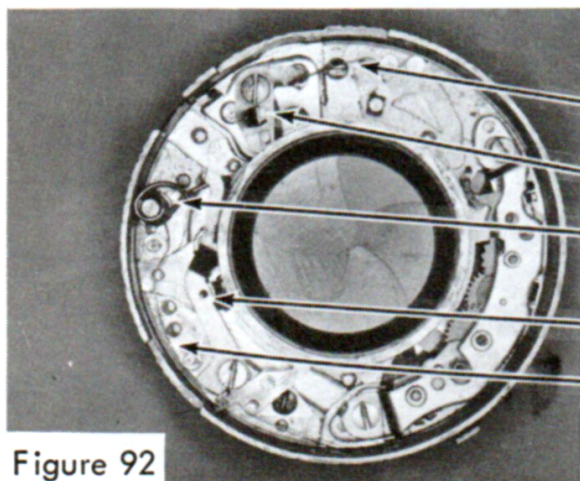


Figure 92

Leaf Lever  
Spring

Leaf Lever

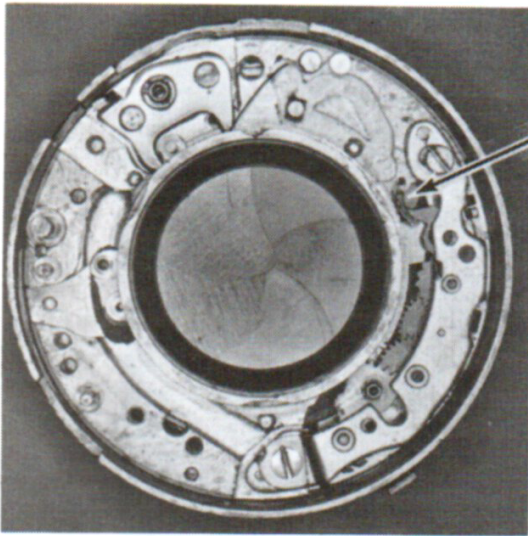
High-Speed  
Spring

Bulb Lever

Bulb Lever  
Spring



On some Compur shutters the bulb lever has no spring of its own and is operated by a dual-purpose spring attached to the inner release lever. This spring operates both the inner release lever and the bulb lever. In these models the inner release lever should be removed first, then the bulb lever.



Pallet Lever All the Way  
Towards Inside of Shutter

Figure 93

The high-speed spring may now be lifted from its post. Disconnect the leaf lever spring from the leaf lever and unscrew and remove the retaining screw and then the leaf lever. The leaf lever spring will remain attached to the mechanism plate and should not be removed.

The retard section in the Compur shutter is a complete sub-assembly, held to the mechanism plate by screws at each end. Observe the action of the escapement retard section. It is quite impossible to move the retard lever unless the pallet lever is held back to at least partially disengage the pallet from the star wheel. With the main lever removed from the shutter the pallet lever can move all the way towards the center of the shutter, Fig 93. In this position, the pallet lever engages the pallet so deeply into the star wheel that it cannot rotate and the entire section is locked up. However, the retard lever can be moved by first pushing the pallet lever towards the outside of the shutter, Fig 94. Before removing the retard section from the shutter follow the above procedure, bringing the retard lever towards the outside of the shutter and then releasing the pallet lever, locking the retard in the position shown in figure 95. Then remove the retaining screws, main spring bracket, and the retard assembly from the shutter.

**COMPLEX ESCAPEMENT RETARD SHUTTER**

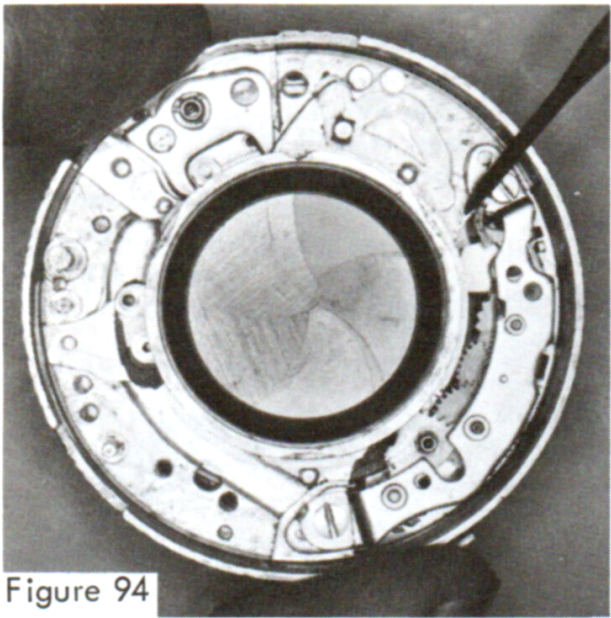


Figure 94

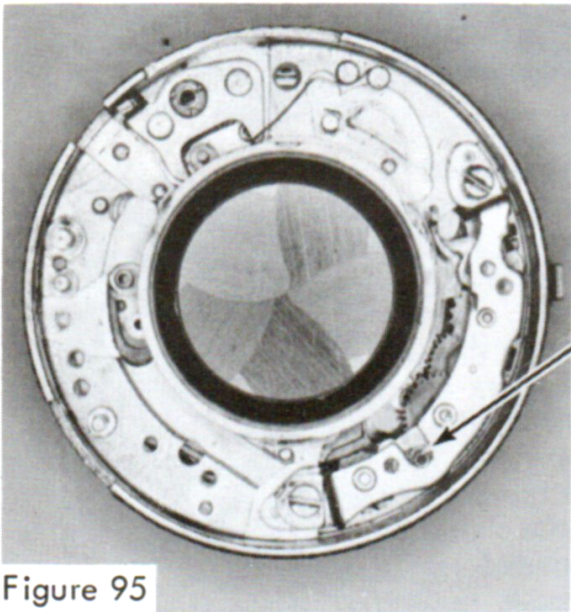
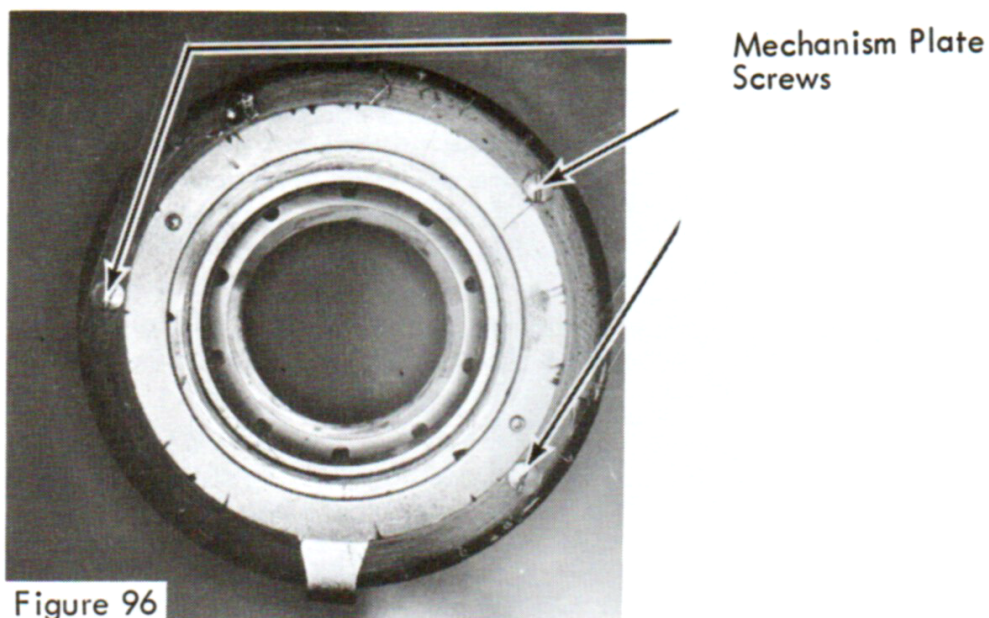


Figure 95

Position of Retard  
Lever before Removal  
from Shutter

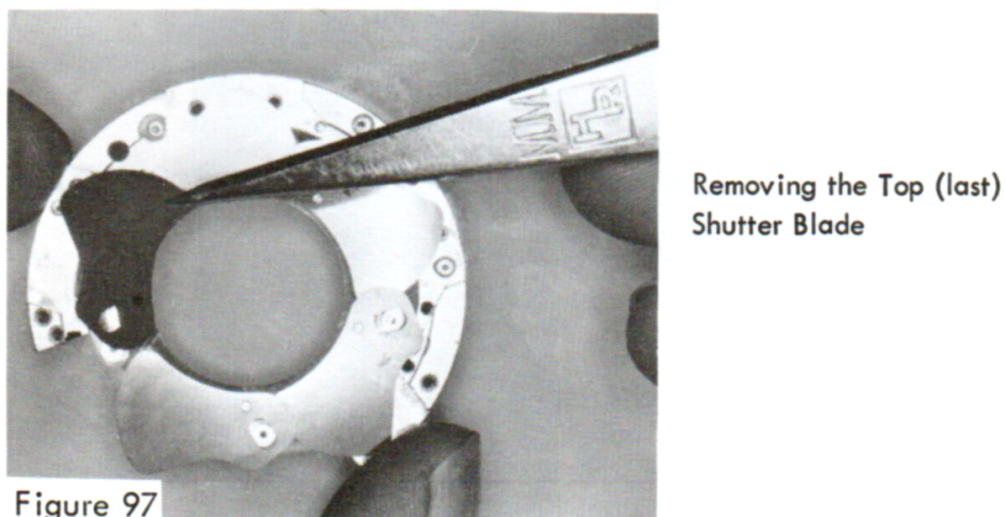
Using tweezers, move the blade operating ring stud normally operated by the leaf lever until the blades are full open. Then turn the shutter over and remove the three screws holding the mechanism plate, Fig 96. With the shutter still upside down, gently lift the shutter housing from the mechanism plate so as not to disturb the position of the shutter blades.



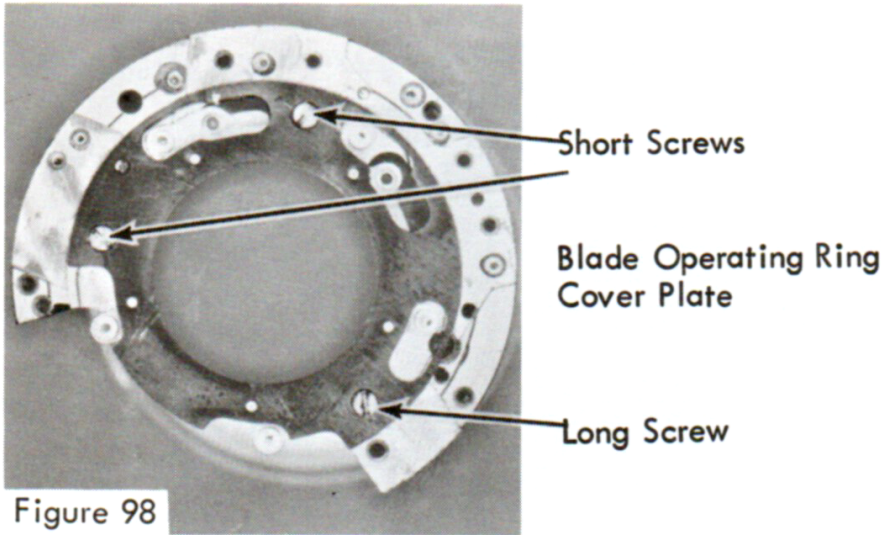


Remove the shutter blades in the usual manner starting with the top blade, Fig. 97.

On models using three instead of five blades, the blades are retained by slotted screws. In other models an extra blade is fitted on the same pins as the first blade and on top of the other blades. Such an extra blade will have three holes instead of the two holes found in the other blades.

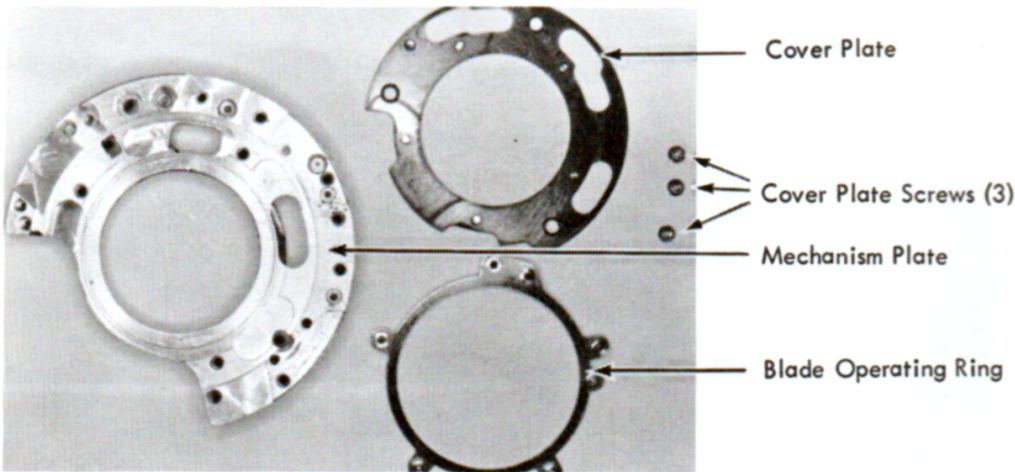


**COMPLEX ESCAPEMENT RETARD SHUTTER**



The blade operating ring is held in place by a cover plate which is retained by three screws. One of the three screws is longer than the other two, Fig 98. Some models will use two long screws and one short one. In either case, you should carefully note the position of short screws as they are taken out and then remove the cover plate and blade operating ring, Fig 99.

On the three blade models, the cover plate is not used. The blade operating ring is held in place by two hex-head screws.

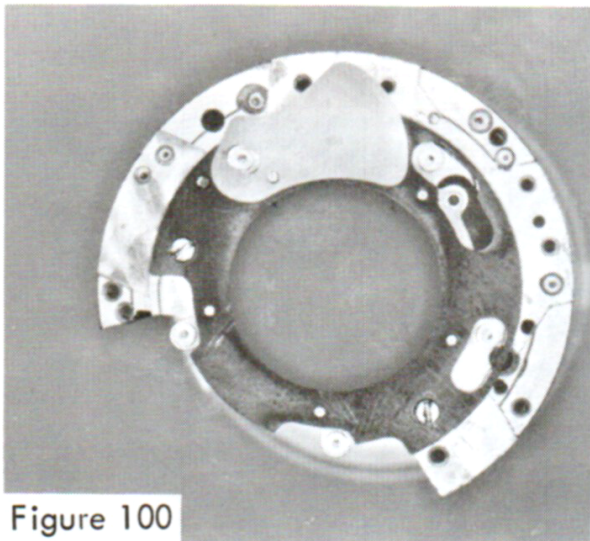


It is not necessary to disassemble the diaphragm at this time, although its disassembly is made in the normal manner. If disassembly is made, record whether the short or long pin goes up, and other differences in the diaphragm wings.



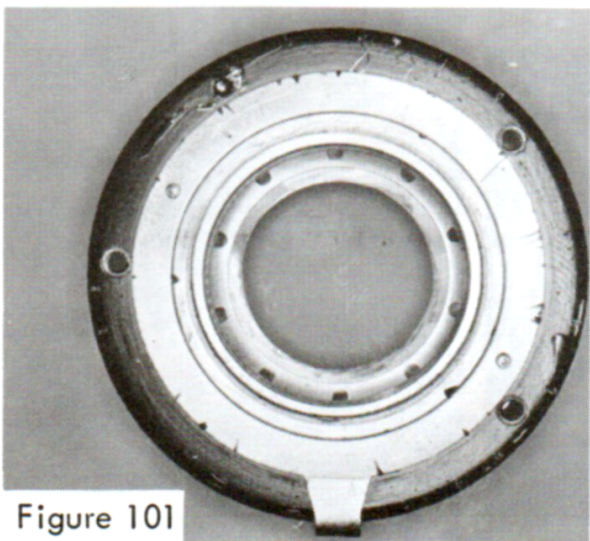
## REASSEMBLY OF THE COMPUR-RAPID SHUTTER

Replace the blade operating ring and its cover plate and screws. Make sure the short screws are replaced in the positions noted on disassembly. Install the shutter blades, starting with the first blade on the pins closest to the leaf lever, Fig 100, and working in a clockwise direction.



First Blade in  
Position

Before installing the shutter housing, be sure the mechanism plate is positioned as shown in the preceding illustrations (97-100). This will place the mechanism plate screw holes at approximately 2, 4, and 9 o'clock. Position the shutter housing in the same manner, Fig 101. Holding the housing directly over the mechanism plate, align the screw holes visually and gently lower the housing around the mechanism plate. Replace the three mechanism plate

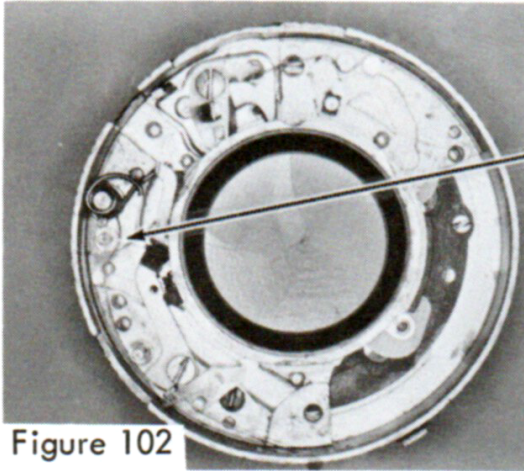


Shutter Housing/Mechanism  
Plate Screw Holes at 2,  
4 and 9 o'clock

## COMPLEX ESCAPEMENT RETARD SHUTTER

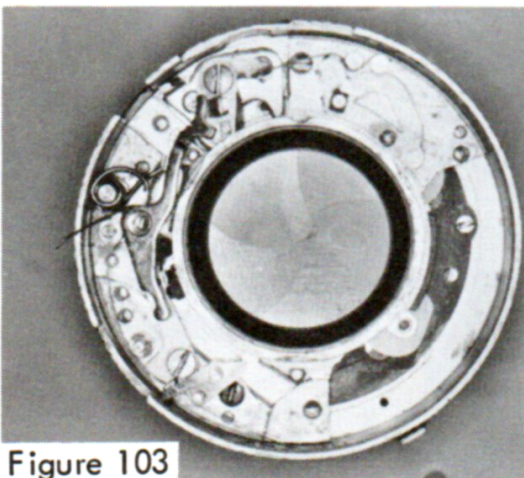
screws and test for free movement of the shutter blades by turning the shutter over and operating the blade operating ring with your tweezers.

Install the leaf lever and connect the leaf lever spring. Replace the high-speed spring, inner release and bulb levers in that order. Make sure the long end of the inner release lever spring is against the shutter housing and the end of the bulb lever spring rests on the bottom shoulder of the cable release lever post, Fig 102.



End of Bulb Lever Spring  
Against Bottom Shoulder  
of Cable Release Lever Post

The installation of the cable release lever requires care and practice. Rotate the high-speed spring counterclockwise until the bottom tail of the spring is against the limiting stud on the mechanism plate. Lower the cable release lever into the shutter allowing it to rest in the position shown in figure 103. Then place your finger over the area where the end of the bulb lever comes under and then up against the cable release lever. Keeping your



Pre-installation  
Position of Cable  
Release Lever



finger pressed against this end of the lever, firmly grasp the other end with your tweezers and pull the lever up and over the cable release lever post, Fig 104. The cable release lever should now

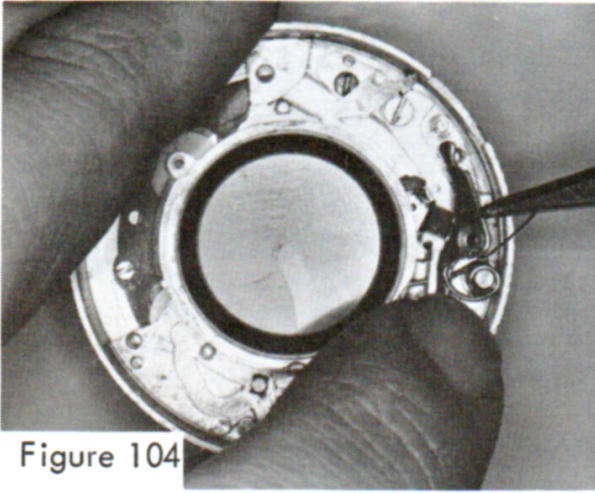


Figure 104

Cable Release Lever  
Being Brought into  
Position

Note:

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

fit at an angle on top of the post. With your finger still pressed against the other end, release your hold with the tweezers and use them as a probe to level out and, at the same time, push the cable release lever down on its post, Fig 105. When the lever is worked all the way down remove your finger and push the end of the cable release lever spring into position against the inside wall of the shutter housing.

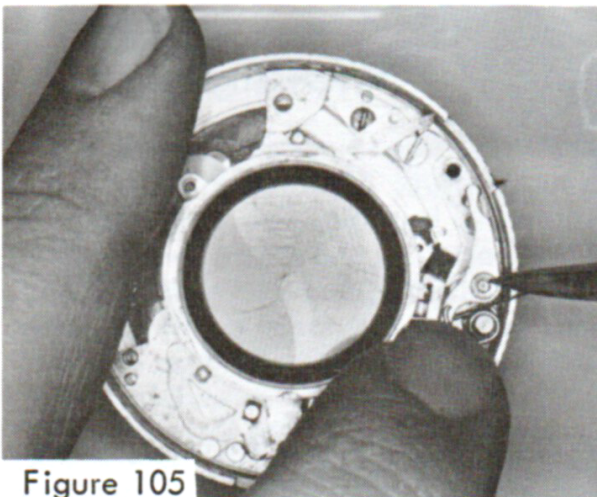


Figure 105

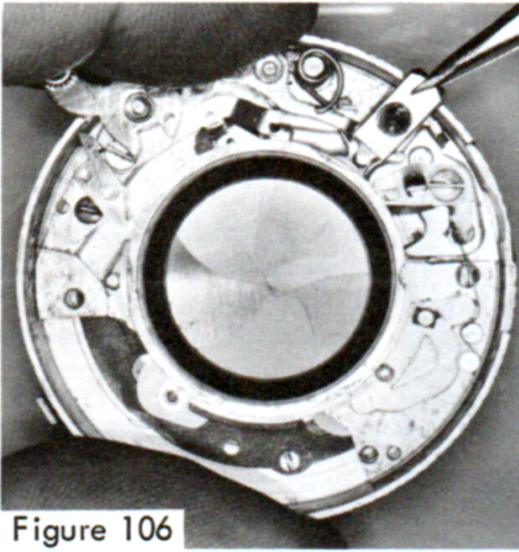
Cable Release Lever  
Being Pushed Down  
on Its Post

Note:

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

Replace the outer release lever and then depress the lever so the cable release socket (and screw) may be slid into position, Fig 106, and tightened down.

## COMPLEX ESCAPEMENT RETARD SHUTTER



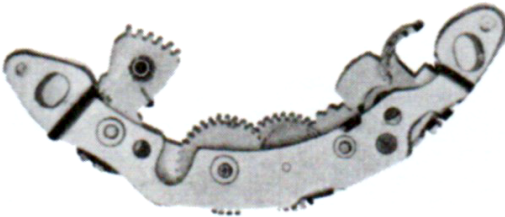
Installation of  
Cable Release Socket

Note:

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

Figure 106

**IMPORTANT:** If the pallet lever is accidentally depressed while the retard section is out of the shutter, the retard lever may disengage from the first gear, Fig 107. It will then be necessary to retension the hair spring on the second gear as follows:

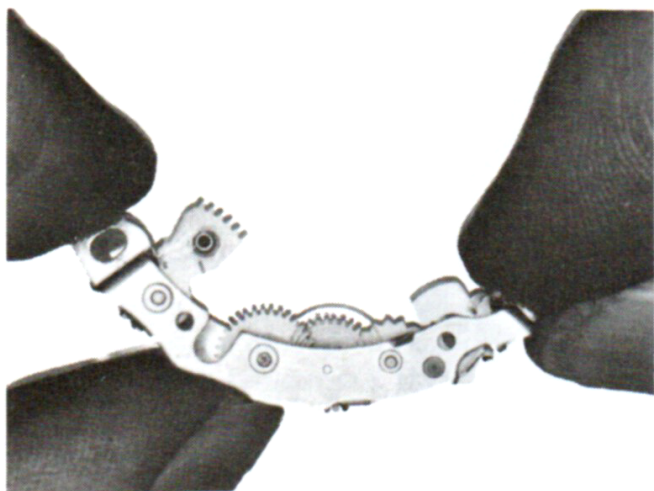


Retard Lever  
Disengaged

Figure 107

Hold the pallet out of engagement and turn the first gear clockwise until the spring unwinds to a diameter slightly larger than that of the first gear, Fig 108. At this point, hold the first gear and engage the retard lever, releasing the first gear as soon as the teeth are well engaged. Continue moving the retard lever until the retard lever stud is against the cutout in the retard cover plate.





Unwinding the  
Hair Spring

Figure 108

Then release the pallet lever, locking the retard mechanism in its correct position for installation, Fig 109.

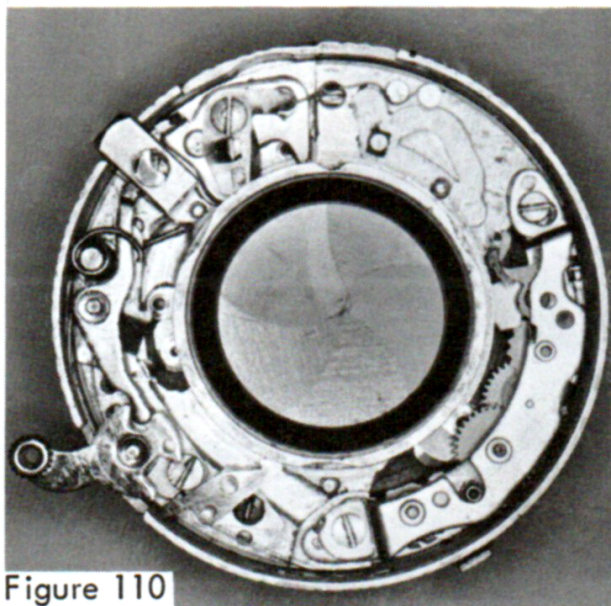


Retard Locked in  
Proper Position  
for Installation  
in Shutter

Figure 109

Now lower the retard mechanism into position on the mechanism plate and replace, but DO NOT tighten, the screw at the pallet end of the retard. Then assemble the main spring bracket and screw at the retard lever end, Fig 110.

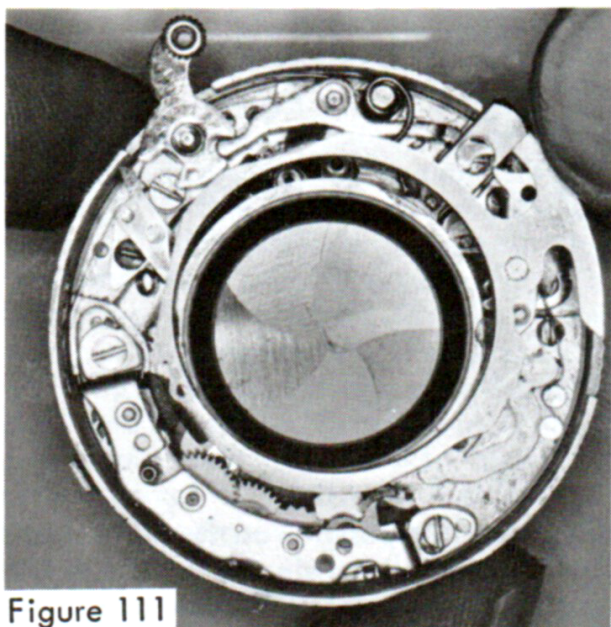
## COMPLEX ESCAPEMENT RETARD SHUTTER



Retard Installed  
in Shutter

Figure 110

Replacement of the main lever is another installation which first seems awkward, but can be completed easily if performed one step at a time. First, pass the free end of the main spring under the inner release lever as you are lowering the main lever around the lens barrel, Fig 111. Be sure the lug on the main lever to which the main spring is attached is between the bulb lever and the lens barrel while lowering the main lever until it reaches the position



Start of Main  
Lever Installation  
with Free End  
of Main Spring under  
Inner Release Lever

Figure 111

Note:

"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.



shown in figure 112. The main lever should now be resting on top of the inner release lever and pallet lever. Now connect the free end of the main spring to the bracket at the end of the retard sec-

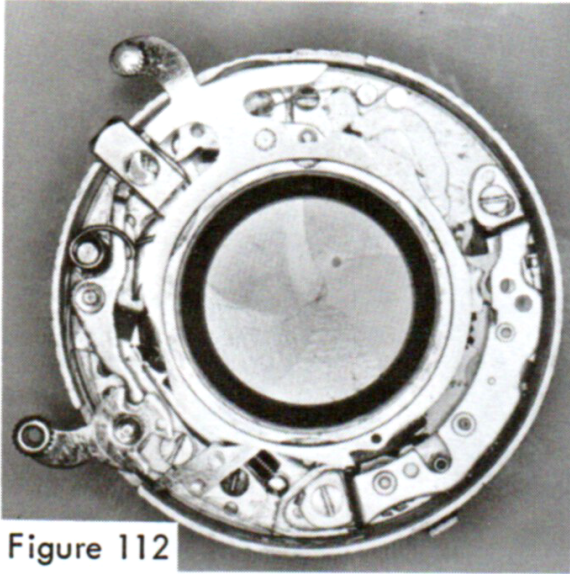


Figure 112

Partial Installation  
of Main Lever

tion. Be sure that the coils of the spring face downward from the connecting loop of the spring, Fig 113. Hold the main lever down opposite the setting lever and pull the main lever clockwise until it settles down against the main lever stop stud, Fig 114. Still keeping the main lever held down, push the pallet lever towards

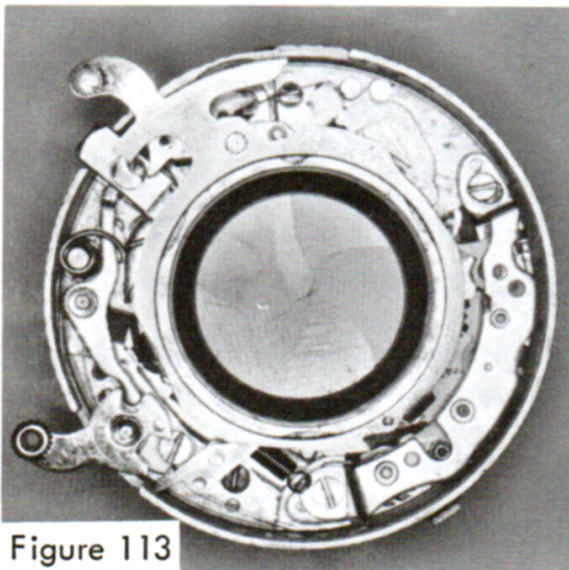


Figure 113

Partial Installation  
of Main Lever with  
Main Spring Connected

## COMPLEX ESCAPEMENT RETARD SHUTTER

the outside of the shutter and the inner release lever towards the lens barrel, Fig 115, so the main lever can settle into its proper position.



Figure 114

Main Lever Stop Stud

Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

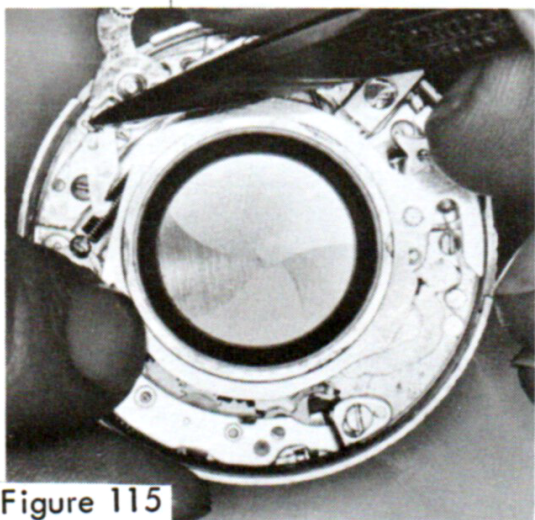


Figure 115

End of Inner  
Release Lever  
Pushed towards  
Center of Shutter

Note:

"Clock" position of shutter has been changed to ease manipulation of illustrated parts.

### TIMING OF THE COMPUR-RAPID SHUTTER

The retard section of the shutter should still not be tightened down. While slightly loose the speed timing may be adjusted.

The retard section can be moved to serve two purposes:

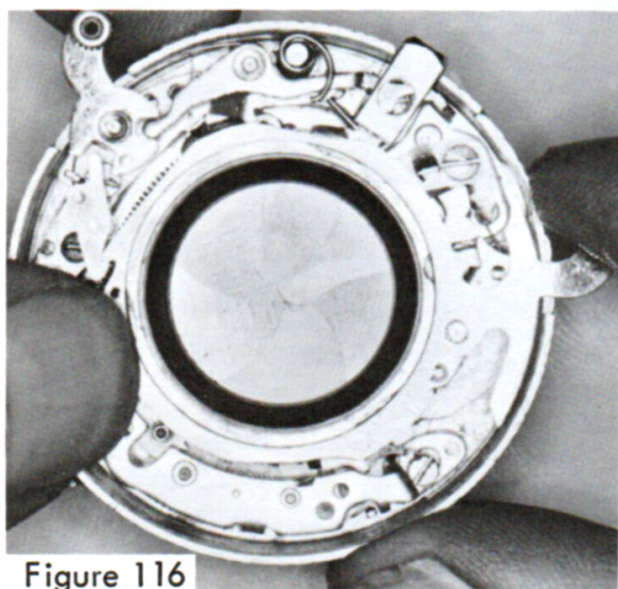
1. The stroke of the retard lever at its end of the retard section may be controlled.



2. The amount of engagement of the pallet at the other end of the retard section may be changed.

Move the pallet end of the retard section towards the center of the shutter for less engagement of the pallet, and shorter exposures on the speeds in which the pallet is used (1 to 1/10 sec.). Move the other end of the retard section toward the center of the shutter, to increase the length of the retard lever engagement with the main lever for a longer exposure. Overmovement is possible - a point can be reached where the retard lever will hang up the main lever, preventing complete action of the shutter.

In order to simplify the adjustment of the retard, start with both ends of the retard section all the way toward the center of the shutter, then back the retard lever end off slightly and tighten the screws. Test the adjustment by setting and releasing the shutter, but you must hold the main lever down when operating the shutter in this manner, Fig 116. (On automatic T and B models, the speed cam control stud on the time latch will have to be held towards the outside of the shutter housing when releasing the shutter.) When the shutter is released it should operate smoothly, delivering approximately a one-second exposure. (Allow the release lever



Main Lever  
Being Held Down  
During Setting  
(cocking) Stroke

Note:  
"Clock" position of shutter  
has been changed to ease  
manipulation of illustrated  
parts.

Figure 116

to return to its rest position immediately after tripping or the bulb lever can engage the main lever.) If the main lever makes a "popping" sound when it disengages from the retard lever during the setting stroke or if the main lever hangs against the retard lever after being released, the retard lever end is still too close to the center. Loosen the screws and move the retard lever end just a small amount toward the outside of the shutter, tighten the screws and test again.

## COMPLEX ESCAPEMENT RETARD SHUTTER

As soon as smooth action is achieved, replace the speed cam and check the shutter action at the 1/10 second and 1/25 second settings. If the retard section is positioned properly, the 1/10 second setting, Fig 117. will be clearly slower than the 1/25 second setting, Fig 118. If the 1/10second setting is faster than 1/25 second then the retard lever end was moved too far towards the outside of the shutter and will have to be repositioned.

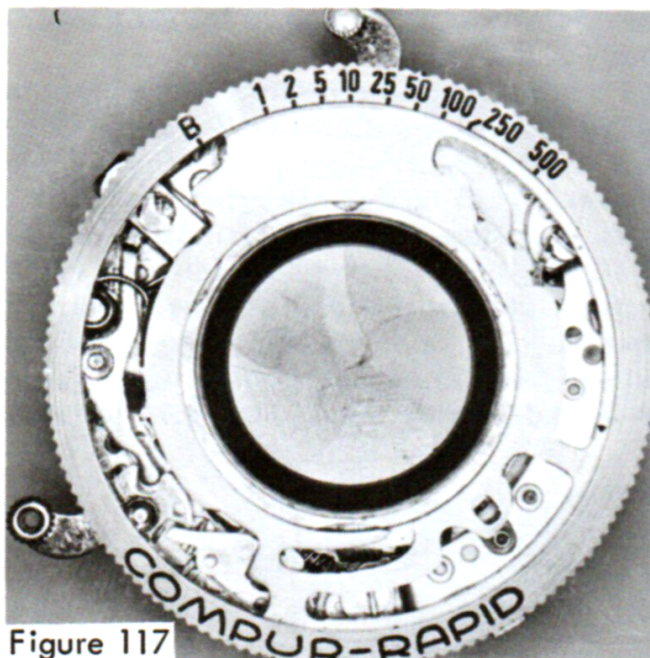


Figure 117

Speed Cam at  
1/10 sec. Setting

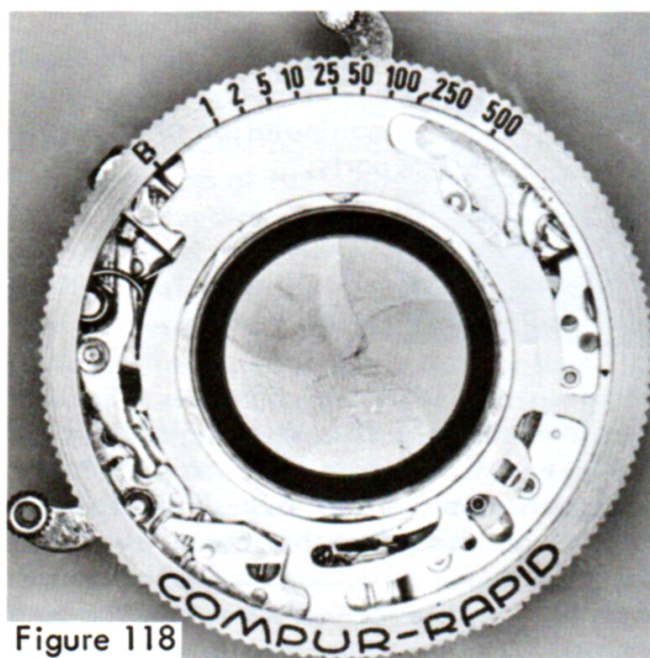


Figure 118

Speed Cam at  
1/25 sec. Setting



Final, precise adjustments involved in the setting of the retard for all speeds will be discussed in a later lesson. At this point you need only set the retard for this rough, visual adjustment. (In any event, it is essential that the retard section be clean before it can be properly adjusted, and it is assumed that your shutter is in that condition.)

To complete assembly, fit the lugs on the nameplate into the grooves cut on the outside of the lens barrel and then rotate the nameplate clockwise until the locking cam (or screw hole) is aligned, Fig 119. Turn the locking cam or replace the screw.

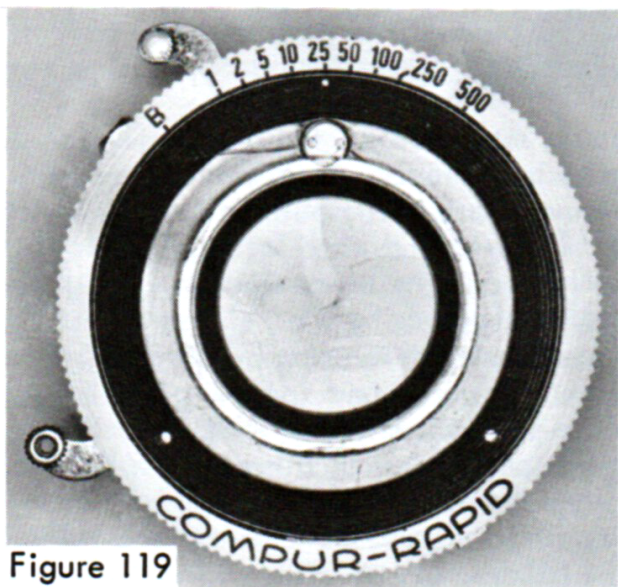


Figure 119

Proper Alignment  
of Locking Cam  
before Turning  
to Locked Position

## VARIATIONS IN THE COMPUR RIM-SET SHUTTER

The following variations are self-explanatory and no illustrations will be used. When these models are encountered in your lesson assignments or actual repair practice you should have little difficulty in analyzing the individual actions.

### Automatic Time and Bulb Action

On some model Rim-Set Compurs, automatic T and B action is employed. Although the basic design of the main lever, cable release lever, leaf lever and retard section are the same as the Compur-Rapid shutter just covered, the time-bulb action is entirely different. It consists of a bulb lever which is "fork-shaped" and attached to the release lever, a time latch and a deflector.

With the speed cam set on Time and the release lever slight-

## COMPLEX ESCAPEMENT RETARD SHUTTER

ly depressed, a notch on the bulb lever contacts a stud which is a part of the blade operating ring, and full depression of the release lever pushes the blade operating ring stud to open the blades. When the blades are fully open a notch on the time latch drops into place behind the blade operating ring stud and holds the blades in the open position. When the release lever is operated a second time the deflector guides the bulb lever to the left so it may disengage the time latch from the blade operating ring and permit the shutter blades to spring back to the closed position.

There are two projections on the time latch. One contacts the speed cam, and the other one contacts the bulb lever. It is the latter projection that permits the bulb lever to push the time latch out of engagement with the blade operating ring stud.

When the speed cam is set on Bulb, the one projection on the time latch rides up on another step of the speed cam. Operating the release lever now permits the bulb lever to open the blades as it did before, but with the time latch pushed out of the way slightly, it can't engage the blade operating ring stud to hold the blades open, and releasing the release lever will permit the blades to close again, delivering bulb action.

Setting the speed cam on one second (or any other instantaneous speed) places the projection on the time latch against an even higher step on the speed cam. In this position the time latch pushes the bulb lever back enough so that it cannot engage the blade operating ring stud and movement of the release lever will not affect the blades.

The cam follower on this model has an extra stud which contacts the speed cam. When the speed cam is set on time or bulb, the cam follower is held in a position that prohibits movement of the main lever and the shutter cannot be cocked. This allows the free movement of the blade operating ring and release lever for automatic time and bulb action.

### Delayed Action Mechanism

Small Compur shutters, such as the model previously illustrated, lack space in the shutter housing for a delayed-action mechanism. However, the delay feature is provided on several of the larger size rim-set Compurs, both with and without automatic time and bulb action. The delay mechanism is located in the area between the release lever and the retard gear train.

Unlike the Supermatic delayed-action mechanism, the Compur delay gear train has no separate drive spring. It is operated



by an additional latch on the main lever. To activate the delayed action, the shutter is first cocked normally. A knob, which projects through the outside of the shutter and behind the setting lever, is moved down (toward the back of the shutter) to remove an obstruction which stopped the setting (main) lever at its cocked position. The setting lever can then be moved a few degrees beyond the normal set position. This extra travel permits the additional latch on the main lever to engage a lug on the first gear of the delayed-action gear train just before it is latched by the inner release lever. (The delayed-action main lever has two latching points for the inner release lever - the second latching point enables the main lever to be latched in its overtraveled position on the delayed-action setting.) Depressing the release lever will permit the main lever to operate the delayed-action mechanism through the latch and the first gear of the train. As the main lever moves toward the normal set position, the first gear of the train revolves only about a quarter of a revolution before the latch disengages from the lug on the first gear and the main lever completes the normal exposure cycle.

### Press-Focus

When using a camera under conditions which permit (or require) ground-glass focusing, several steps are normally involved. With no film in the camera and the ground-glass in position, it is necessary to produce an image on the ground-glass so that adjustments may be made to bring the subject into proper focus. Of course, the shutter must be open before any image will be formed. It may be opened at the time setting on the shutter. Thus, the shutter is set on time and cocked. It is released once, so the shutter remains open during the focusing operation, and then the shutter is tripped once more to close the leaves. Finally, the speed cam is returned to its proper setting for the picture being made.

Under certain conditions, such a procedure is acceptable, but when quick work is important the process of moving the speed controls of the shutter to time, opening and closing the shutter and perhaps the diaphragm and then returning to the normal speed setting, is time-consuming to say nothing of the danger of forgetting to readjust the settings.

A press-focus lever, or button, provides a way to open the shutter blades and keep them open regardless of the shutter speed setting. It permits rapid checking of the focus on the ground-glass without changing the speed setting of the shutter. Some

## COMPLEX ESCAPEMENT RETARD SHUTTER

Compur models have a press-focus feature incorporated in place of the delayed action. On such models, a button on the outside of the shutter housing places an obstruction in the path of the setting lever whenever the button is depressed after the shutter has been set. When the shutter is released, the obstruction halts the movement of the main lever at the point where the blades are wide open. Resetting the main lever returns the stop obstruction to its normal position permitting an exposure to be made as usual.

Other Compur models, both with and without delay mechanisms, employ a lever-type press-focus which functions independently from the setting lever. Depression of the press-focus lever opens the blades through its contact with one part of a special two-piece leaf lever.

### Size Designations

Since the basic design of all rim-set Compur shutters is the same, the slight variations encountered due to size differences between shutters should not create any particular problem in normal repair work. However, when ordering replacement parts it is essential that the size of the shutter be given. All of the measuring points necessary to determine the correct size of a Compur shutter are given in your "Camera Repairman's Handbook". The sizes are designated as 00, 0, 1 and 2. The Compur-Rapid shutter illustrated previously is an 00 size.

The dimensions used by several other shutter manufacturers are also shown in the "Handbook". The Supermatic and Kodamatic shutter sizes are shown directly on the shutter nameplate.

### THE RAPAX SHUTTER MAIN LEVER

There are various types of main levers, and understanding many of them will simplify work on any shutter. The rim-set Compur shutter main lever is unique, although the older dial-set Compur shutter main lever (or operating cam idea) has been utilized in many shutters.

In the Alphax, Universal, **Dakon**, and Ball Bearing shutters that have been discussed, you have seen a common type of main lever, usually pivoted at a point approximately midway between the release lever and the leaf lever and often found in the automatic-type shutter. The same style of main lever is also used in a double-action shutter, the set-and-release Rapax shutter, Fig 120.



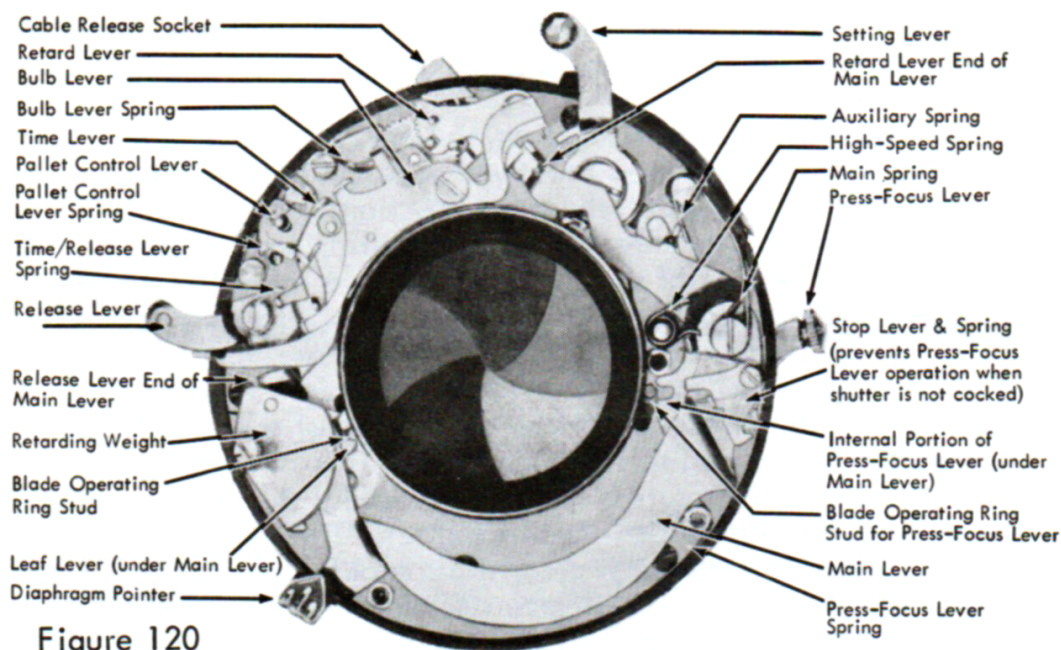


Figure 120

In the Rapax shutter, instead of the shutter being released upon the completion of the setting stroke (as in automatic shutters), the end of the main lever, closest to the leaf lever, is latched to a portion of the release lever. Thus, it remains set until the latch on the release lever is moved out of the way, permitting the main spring to move the main lever through its operating cycle.

Neither the leaf lever nor the leaf lever end of the main lever moves the retard lever. It is the setting lever end which has a lug to operate the retard lever and the gear train of the retard section. The time and bulb levers in the Rapax function in a manner similar to those parts in the Alphax shutter.

There are several similarities between the Rapax shutter and the Compur and Supermatic shutters plus a few things which are new. The Rapax shutter utilizes the speed range system to obtain speed variety: a pallet engaged star wheel for speeds from 1 to 1/10 of a second; a gear train with no pallet engaged acting as an inertia retard for intermediate speeds; and the high-speed spring to quicken the action of the shutter at its highest speed. The Rapax shutter has no built-in delayed action, but it does include design features which are not found in the shutters discussed previously.

## THE SNUBBER OR RETARDING WEIGHT

Unique in the design of the Rapax shutter are two other units. In addition to the main spring the Rapax shutter incorporates an additional or "auxiliary" spring to operate the main lever. The

## COMPLEX ESCAPEMENT RETARD SHUTTER

use of two lighter springs, instead of a single heavy one, tends to reduce fatigue in the springs and makes for easier assembly and disassembly.

The auxiliary spring also tends to bolster the strength of the long Rapax main lever at a point where it could be weakest (between the main spring and the retard section).

In order to obtain more efficient operation at the next-to-the-highest speed setting of the Rapax shutter, a retarding weight is included in the design. It is a simple inertia retard to slow down the action of the main lever (while the leaves are open) at this one speed setting. The "snubber" or retarding weight is pushed out of the way by a lug on the speed cam at the highest speed at the same time as the high-speed spring is engaged. It is interesting to note that accuracy of exposure is impossible without the various retarding devices that are built into this shutter. The retarding weight does not seem to make any great difference in the action of the shutter at the next-to-highest speed setting when judged visually, but the actual speed obtained may be as much as 50% shorter without the use of the device.

You will find a small spring in the retarding weight assembly of the Rapax shutter. The spring does not aid in retard but merely acts to return the weight to its normal position prior to releasing of the shutter. The spring has no practical effect on the exposure obtained.

### THE PRESS-FOCUS LEVER OF THE RAPAX SHUTTER

The Wollensak Rapax shutter incorporates a separate press-focus lever to contact the blade ring. With it, the photographer can open the blades of the shutter whenever the shutter is set regardless of the speed adjustment at the time.

This lever is located on the mechanism plate and under the main lever at approximately 3 o'clock. It is interlocked with the main lever, so that the shutter must be set before the blades may be opened.

When the press-focus lever is pushed in and down (on a track) it engages a pin attached to the blade control ring and opens the blades. When the press-focus lever is returned it carries the blades back closed again.

### VARIATIONS OF THE LEAF LEVER SPRING

You have seen several different types of leaf lever springs in use in the more complex multiple-speed shutters.

The leaf lever spring may perform several functions. It may be used only to hold the leaf lever in contact with a blade operating



ring stud. It may also be used to hold the shutter blades closed, and in this usage there is a very interesting problem.

At high shutter speeds, the blades operate so rapidly that there is a possibility of the blades bouncing open after closing completely at the end of an exposure. A spring used to keep the shutter closed might be insufficient to prevent this bounce.

In the Rapax shutter, for example, the main lever first opens the blades with one projection which moves the leaf lever, and then closes the blades using a second projection contacting another part of the leaf lever. With such operation, a simple spring to keep the blades closed would close them as soon as the main lever lost contact, so a special detent type spring is used to actually latch the leaf lever in the closed or open position. The action of this spring can be detected when operating the press-focus lever of the Rapax shutter. The press-focus lever has its own spring to return the blades to the closed position. When the press-focus lever is in its normal, nonoperative spot, it is not in contact with the blade operating ring and the leaf lever spring maintains the blades in the closed position.

This latch-type leaf lever spring has certain advantages. It does not exert any force toward closing the blades while they are in operation, but does tend to keep the blades closed once they are closed by some other means. The main lever does not have to overcome spring tension to open the blades.

Most other shutters utilize a leaf lever spring or a blade operating ring spring which tends to keep the blades closed or to close them regardless of the position of the blades. The main spring in many shutters, like the Compur and Supermatic, is a factor which prevents blade bounce since the main spring holds the blades closed when the shutter operating cycle is completed.

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